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The AUTOMOBILE

Improving the Steering

A Part Often Neglected in Design — Common Failings in General Layout of This Important Part

By A. Ludlow Clayden

IF an ordinary motorist ever has the opportunity of driving a good racing car the thing which impresses him most strongly is commonly the wonderful ease of the steering. The best racing cars can be steered at a good speed literally with two fingers. By contrast, the average automobile needs careful handling at high speed and often the operation of the steering in turning a right-angle corner calls for a distinct effort and a strong grip if one hand is to suffice.

There is no magic about racing car steering, it is not especially costly nor is it of peculiar design, but it is designed as carefully as the motor because *it has to be*. On an ordinary car a steering that is very stiff as compared with racing practice is good enough so the engineer has been prone to leave it alone and it remains no better than it was in the dark ages of automobilism when a driver had to be something of an athlete. Yet a man who once has handled an easy-steering car will never be satisfied with any other, for the difference it makes to the physical condition after a long day on the road is remarkable and has to be experienced to be believed.

Fundamental Imperfections

Practically every automobile has the same type of steering so far as system is concerned, the inventor of the conventional front axle with swivel heads at each end bearing the name Ackerman. With Ackerman steering it is generally assumed that the tie rod arms projecting from the swivels should meet at the middle point of the rear axle if their center lines are produced. Now, when on a curve the two rear wheels run along two circular paths of different radius, and each wheel makes a tangent to its rolling circle, as viewed in plan. The front wheels meanwhile roll on separate circles of their own and the ideal steering gear is such that each of the four wheels should make a tangent to the circle along which it is rolling.

This true rolling can occur at three positions only: One is the straight position when the car is turning neither to right nor left, and the other two are at some definite angle of lock to right and left respectively. The effect for all other positions is that three wheels may roll perfectly but the fourth must do some skidding or perhaps two roll and the other two divide the skid between them.

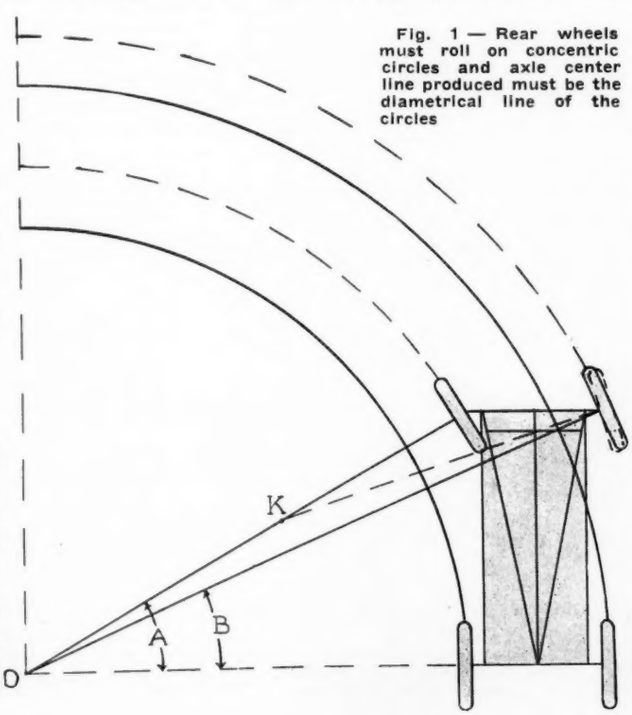
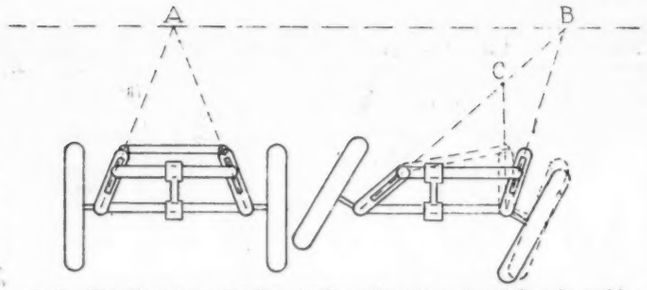


Fig. 1 — Rear wheels must roll on concentric circles and axle center line produced must be the diametrical line of the circles

From Fig. 1, it is obvious that the rear wheels must both roll on concentric circles and that the rear axle center line produced must be the diametrical line of the circles. Thus neither one of the rear wheels can skid unless both do. Suppose the point about which the car is turning is *O*, then the center lines of both the front wheel spindles must meet at *O* if every wheel rolls perfectly, without skidding. It is obvious that by turning the steering wheel we can bring one of the front wheels into such a position that the spindle center line passes through *O*, but the second front wheel will then take up a position depending upon the length of the tie rod and the layout of the tie rod arms. If the tie rod slid in guides attached to the front axle and



Left—Fig. 2—Ideal steering design, the tie rods sliding in guides attached to the front axle and the pins at its ends moving in slots cut in the tie rod arms. Right—Fig. 3—Ideal design illustrated in Fig. 2 with the conventional type steering dotted over it. In both views the right arm is supposed to be in the correct position and the left arm is correct as shown in the full line. The dotted lines show the inaccuracy of the conventional system

the pins at its ends moved in slots cut in the tie rod arms as sketched in Fig. 2 there would be no steering error whatever and the second front wheel would always be a tangent to its rolling circle, but such a construction is mechanically impractical. In Fig. 3, the ideal design of Fig. 2 is shown with the steering of the conventional type dotted in over it. In both views the right arm is supposed to be in the correct position and the left arm is correct as shown in full lines. The dotted lines show the inaccuracy of the conventional Ackerman systems.

This is exaggerated a little, but turning back to Fig. 1, assuming that the inner front wheel is at a correct angle, the tie rod may easily draw the outer wheel into a position as indicated in dotted lines. When this happens the rear end of the car is endeavoring to turn on a circle with center at *O* while the front end is trying to turn about *K* Fig. 1. Obviously this is impossible, and so the true turning point will depend upon which of the wheels skid.

Another thing shown by Fig. 1 is that the two front wheels must never be parallel except when in the straight position, as the angles *A* and *B* must always be different. It is possible to calculate the angular movement of the outer wheel spindle to correspond to any given angle of lock of the inner wheel, so that the center lines of the spindles may intersect at *O* and all wheels roll properly, but the equations are cumbersome and there is no need to quote them.

In Fig. 4 is shown the layout of a front axle and steering. The angles shown by full lines on the right circle are the angles which correspond to those on the left circle, if we are to have perfect rolling. For this example the wheelbase of the car is taken as 108 in. and the distance between the steering swivels *OQ* as 50 in. Now assume that we use a length of tie rod arm of 10 in. and choose any angle θ between the tie rod arm and the center line of the chassis. Then, when the left wheel moves to angles 10, 20, 30 and 40 deg. the right wheel ought to move to the positions shown in full lines, but the inaccuracy caused by the tie rod causes the actual positions to be as shown in dotted line. Now, the angle of error *E* is shown by the difference between the full and dotted lines on the right hand side as marked at *E* and the amount of this angle depends upon the length of the tie rod arms *OA*, *OB* and the angle θ which the tie rod arms make with the center line of the car.

It has become a habit to make this angle such that the tie rod arms produced would meet at the center of the rear axle, but this does *not* give the nearest approach to accuracy, by any means necessarily. With the proportions chosen for the diagram of wheelbase 108 in., distance *OQ*, 50 in. and lengths *OA* and *OB*, 10 in., the average of error is much lower when θ is chosen of such a value that the produced tie rod arms would meet much nearer to the middle of the car than to the middle of the rear axle.

Striking the Mean

There is no need to go into the mathematics of the layout, for they are quite simple and individual cases can be worked out by anyone, but a few conclusions are worth comment. It can be shown either graphically or by calculation that:

1—Where the tie rod is in front of the axle the inaccuracy is *in*creased by increasing the length of the tie rod arms.

2—Where the tie rod is behind the axle the inaccuracy is *de*creased by increasing the length of the tie rod arms.

Thus suggesting that there is advantage in the use of long arms as a rule, but there is something else to be considered. In Fig. 4 a front axle and tie rod are shown as they lie when the steering is locked over and it is obvious that we must not allow the angle ϕ, ever to become too large, for the greater it grows the less is the leverage which the tie rod exerts over the wheel.

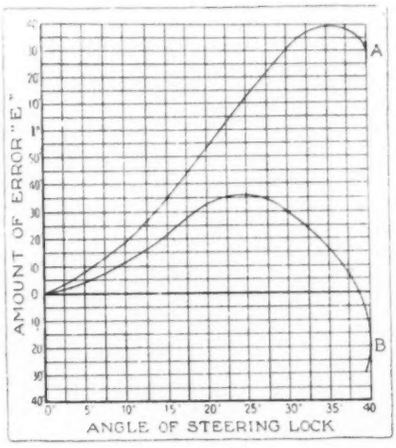
It is easy to see that there is a limiting position when the angle ϕ would become nothing and then the steering could not be moved back again to the straight position. Unfortunately for the engineer this angle varies inversely as the error. That is to say:

1—With the tie rod in front the angle ϕ is increased by *shortening* the arms.

2—With the tie rod behind the angle ϕ is increased by *lengthening* the arms.

Probably with the usual weight of car the angle ϕ ought never to be less than 150 deg., so all we can do is to make the tie rod arms of a length to suit this condition and they will then be as nearly accurate in action as we may hope to get them, if we choose the best value for θ.

The only way in which to determine the best proportions of tie rod layout is to calculate the correct angular proportions and then to try different values of tie rod arm length till the happiest mean is struck. Fig. 5 may be of interest as showing the plotted errors for the proportions of chassis



Left—Fig. 5—Showing the plotted errors for the proportions of tie rod layout in chassis chosen for Fig. 4. In upper curve error E is plotted for a value of θ such that the tie rod arms would meet in the rear axle center. Below—Effect of increasing θ to 15

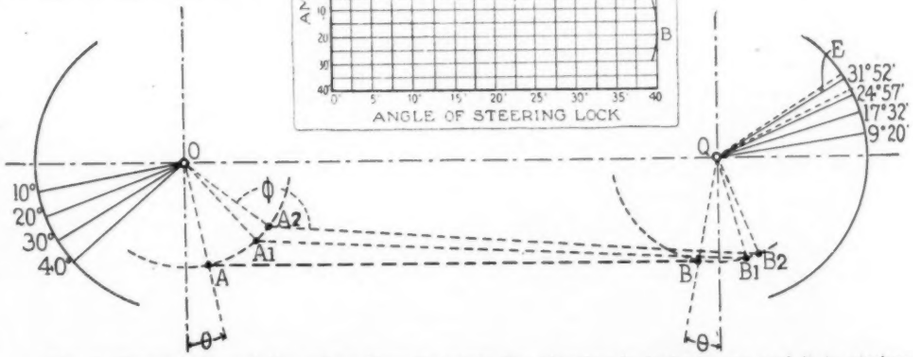


Fig. 4—Front axle and tie rod as they lie when the steering is locked over and it is obvious that the angle Φ must never become too large, for the greater it grows the less is the leverage of the tie rod over the wheel

chosen for Fig. 4. In the upper curve the value of the error E is plotted for a value of θ such that the tie rod arms would meet in the rear axle center. The far better curve below shows the effect of increasing θ to 15.

Another useful point which may be brought out by drawing a series of diagrams for different cases is that an increase in wheelbase increases the accuracy of the steering, but it is not necessary to use space here to show it for it can be easily worked out by anyone.

Errors Cause Large Forces

What then is the effect of manufacturing axles in quantity and using the same axle set for cars of differing wheelbase, as actually happens? The answer is that it is a matter of pure luck whether the steering is fairly good or fairly bad. The reader may think that, as the angular errors are only a degree or two at most, this accuracy is hardly worth troubling about, but there is one way of stating the case which brings home the forces at work.

Suppose that the road is dry and that all four tires hold on well, then in rounding a curve it might be possible for the two front wheels to roll truly without skidding (on center K Fig. 1.) If this happened the two back wheels would be forced to skid together and outwards, in an effort to counteract the steering effect of turning the wheel. In other words the driver is applying a heavy push to the inner end of the rear axle and is forcing the rear wheels to skid sideways by a quite large amount. Even if the distance is small it is obvious that the lead is considerable, and quite sufficient to make the steering heavy or inaccurate in direction. During a turn on a dry road the amount of power wasted in rubbing the tires which take the skidding action may easily exceed a tenth of a horsepower which does not sound a very large amount but is quite sufficient to be worth considering.

An Unconsidered Power Loss

Now comes a still more curios fallacy which is the idea that it is an advantage to cant the front wheels by tilting the spindles relative to the swivel centers, or *vice versa*. In Fig. 6 is shown the normal constructions, of splaying the wheels so that the tires are nearer together on the ground line than they are at the top.

Consider one of the wheels. It leans over sideways, yet the ground may be assumed to be flat. Thus the tire bears more heavily on one side of the tread than upon the other. Produce the axis of the wheel till it cuts the ground and it is at once clear that a little section of the tire has become part of the surface of a cone with its center at O and its side resting on the ground. This makes the wheel with its tire into what is virtually a bevel blank with a very large angle.

Now if we rest a bevel blank on the ground on edge as in Fig. 7, and then push it in the direction of the arrow, it will not run straight forward, but will run in a circle with a center at the natural cone center. So with the wheel and tire in Fig. 6. Its natural tendency, by virtue of the tilting, is to run in a circle also, and we prevent it from doing so, because the opposite wheel is also trying to run in a corresponding, opposing circle and the two pull against each other. The effect is that the tire tread is worn unevenly and the extra amount of power used up in wearing down the outside edge of the tread is pure waste. Again the amount is small and the effect is not great in any way, but little is gained by the splayed wheel and something is lost.

Castor Swivels

It is necessary to say something here about the various so-called castor systems of steering, of which some are good, and some have advantages existing mainly in the imaginations of their originators. To grasp the subject, first consider the forces at work on the wheel, which are the driving force of the car, the weight carried by the wheel and the resistance of any object which the wheel encounters on the road. The driving force and weight together must have a resultant equal and opposite to the resistance.

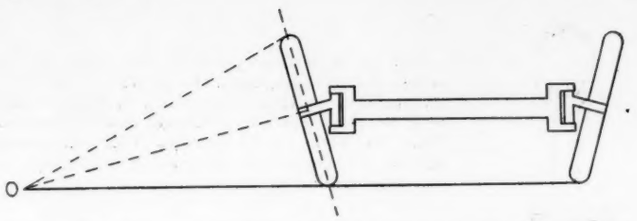
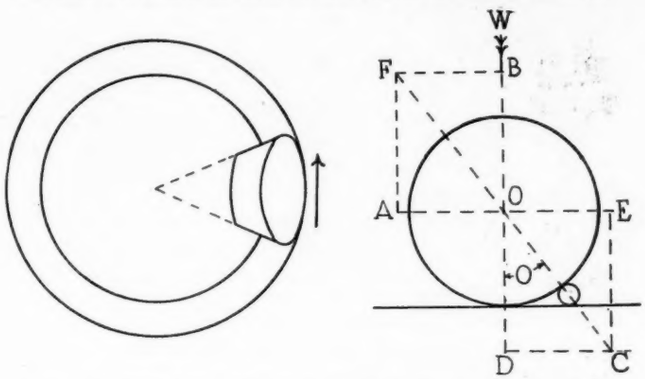
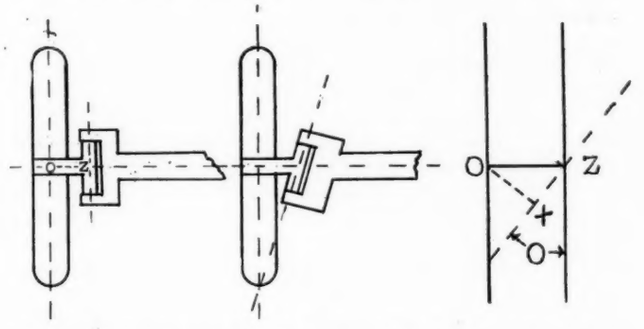


Fig. 6—Normal wheel construction, the wheels being splayed so that the tires are nearer together on the ground line than at the top



Left—Fig. 7—If a bevel blank is rested on the ground on edge and is pushed in the direction of the arrow it will not run straight forward but in a circle with the center at the natural cone center. Right—Fig. 8—Diagram of forces as the wheel strikes an obstacle. Graphically resolved there are the weight BO and the driving force AO. The resistance of the obstacle on the road must act along the line CO, thus if CO is made equal to the force the resultant FO of AO and BO must be equal and opposite to CO



Left—Fig. 9—If the plane of the wheel is vertical and the distance from the plane to the vertical axis of the steering swivel is OZ then the couple tending to turn the wheel about its swivel pin is OZ.W tan θ. Center—Fig. 10—A design where the swivel is tilted sideways so that its axle produced meets the ground at the same point as the tire. Right—Fig. 11—Another analysis of the forces, showing that the couple tending to turn the swivel is not zero, but merely reduced to OZ . cos Φ .W tan θ

Striking an Obstacle

First to take the case of the ordinary vertical pivot, assume the wheel to be striking an obstacle as shown in Fig. 8. Resolving the forces graphically we have the weight BO and driving force AO. The resistance of the object on the road must act along the line CO. Thus if we make CO equal to the force, the resultant FO of AO and BO must be equal and opposite to CO.

But CO itself can be resolved to match the other diagram of forces, into DO and EO, whence EO equals W tan θ.

Turning now to Fig. 9, if the plane of the wheel is vertical and the distance from the plane to the vertical axis

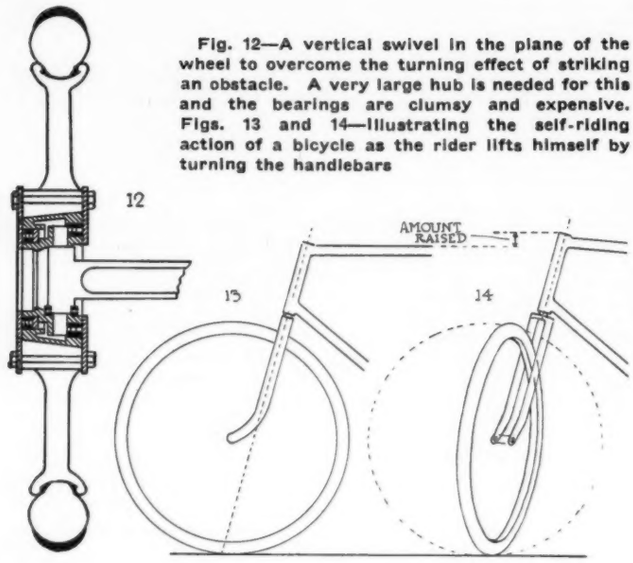


Fig. 12—A vertical swivel in the plane of the wheel to overcome the turning effect of striking an obstacle. A very large hub is needed for this and the bearings are clumsy and expensive. Figs. 13 and 14—Illustrating the self-riding action of a bicycle as the rider lifts himself by turning the handlebars

of the steering swivel is OZ, then the couple tending to turn the wheel about its swivel pin is

$$OZ.W \tan \theta$$

Now, by virtue of our original diagram of forces Fig. 8, it follows that the force $W \tan \theta$ always acts at the center of the wheel in the plane of the wheel. In other words it acts at O, whether the steering swivel be vertical or not.

In Fig. 10 is shown a design where the swivel is so tilted sideways that its axis produced meets the ground at the same point as the tire, the idea being that the resistance to shock is *horizontal* and not at an angle depending on the height of the obstacle, as has been proved to be the case by the analysis of forces in Fig. 8. The notion is that as the point of contact of tire with road is vertically beneath the swivel axis there is no turning moment on the swivel.

But let us analyse the forces once more. In Fig. 11, let OZ be the horizontal distance from the center line of the swivel pin to the central plane of the wheel. Draw OX at right angles to the swivel pin. From Fig. 8 we know that the reactionary force due to the obstacle is $W \tan \theta$. Resolving the diagram of the tilted pivot Fig. 11, it follows that the force $W \tan \theta$ acts on the swivel at a leverage OX instead of a leverage OZ as in the vertical pivot. Now OX equals $OZ \cos \phi$ where ϕ is the angle between the pivot and the vertical, so the couple tending to turn the swivel is not zero, but is merely reduced from OZ, $W \tan \theta$. to OZ. $\cos \phi$. $W \tan \theta$.

Similarly the converse of the tilted pivot has been suggested, the wheel being dished till the point of contact of tire with road is directly under the swivel as Fig. 6. Here the turning moment on the swivel is lessened slightly more than with the tilted swivel, but it still remains a substantial force.

There is one way only of overcoming the turning effect of striking an obstacle, and that is to use a vertical swivel *in the plane of the wheel.* This system has been used with conspicuous success on some foreign omnibuses and is perfect from a geometrical viewpoint. The system is sketched in Fig. 12, but its drawback is that a very large hub is needed and the bearings become clumsy and expensive.

The true meaning of caster action is that the steering wheels shall return to the straight position when the wheel is released after making a turn, and to get this action we require to utilize part of the weight of the car to provide a restoring force. In other words we must lift some part of the car a trifle when the steering wheel is turned to right or left. The reason that a bicycle has a self-righting action is that the rider lifts himself by turning the handle bars. The wheel is touching the ground at a point behind the point where the produced steering swivel would strike it as shown in Fig. 13. This being the case, turning the front forks around lifts the whole front end, Fig. 14.

Just the same effect can be obtained by inclining the steering swivels of an automobile by a degree or two, so giving them a little rake, and in this connection it may be mentioned that when a car steers badly and has a tendency to wabble at high speed, it is often possible to effect a complete cure by slacking off the front axle clips and driving in tapered wedges of hard wood so as to give the swivels a backward tilt. Such rake is more effective with central swivel steering as Fig. 12, but it is a real advantage with the usual sort of axle.

The Cure for Flapping

Another point that is not fully appreciated is the cause of "flapping." Often it may be noticed that a car running over a rough road has its front wheels in a state of oscillation from side to side, even when the steering wheel is held rigidly central. To understand this Fig. 15 shows a drag link and its connections. If the steering wheel is held rigidly A is a fixed point and if the axle rises and falls relatively to the frame the drag link must swing about A as a center. This means that the front end of the link B, will move along the arc of a circle with radius AB. Let C be the point nearest to the frame which B can reach as the car takes a bump. Then when B is raised to coincide with C it is not only lifted but is drawn back by an amount DC equal to the difference between the circular path of B and the true vertical. Similarly, on the rebound the same sort of action occurs, and running over a bump is the equivalent of giving the steering wheel movement enough to steer the car by pulling the drag link a distance DC.

Obviously the longer the drag link the smaller the effect of this action, as the length of the link is the radius of the circle, also by choosing the most suitable relative positions for A and B when there is no shock to disturb things, we can make the arc BC correspond fairly closely to the vertical line. Usually it is found that the best compromise is obtained by raising the front end of the link a good deal, so that the amount DC is divided fore and aft of the vertical as shown dotted in Fig. 15, for with this layout the deflection caused by the rebound will be opposite in direction to that caused by the compression of the spring.

So much for layout considerations. The forces concerned are small, the inaccuracies slight, but time spent on determining the best compromises is amply repaid by the ability to steer accurately to an inch, which is lacking as a rule. Some cars which steer well do so because the connections were proportioned correctly by accident, but if this happens with one model it does not follow that it will do so again with the next unless the layout of the good car is analysed and the reason for the accuracy discovered.

Quite apart from layout is the question of detail design of steering gear parts, and this is just as important in the pursuit of good acting steering. This phase of the subject the writer intends to take up shortly in THE AUTOMOBILE.

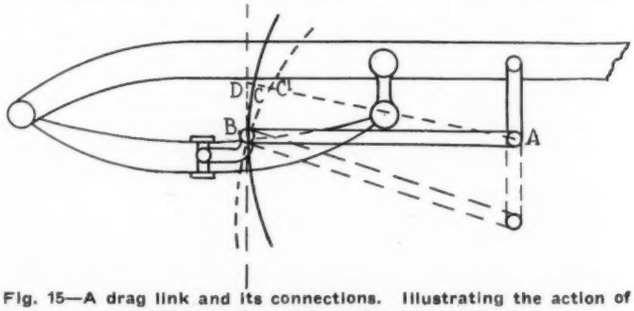


Fig. 15—A drag link and its connections. Illustrating the action of the forces set up in running over a bump

Register Trade Marks in Latin America

Often Unscrupulous Persons Register the Trade Marks of Well Known Foreign Manufacturers and Thus Control All Right To Sell Goods Under Those Marks

By Our United Export Bureau*

UNLESS a manufacturer has protected himself it is possible for any one in Latin America to register his trade mark and stop him selling his products in these republics. In some countries goods become the property of the person or persons controlling the trade mark on them, for this reason merchants in those countries only purchase goods from those controlling the trade mark.

Some unscrupulous people make it their business to register well-known foreign trade marks, thus compelling a manufacturer to either purchase his trade mark or lose the advantage of a well-known brand, which has been developed at a large expenditure of time and money. Hardly a week goes by that a case of this character is not brought to our attention.

The Spanish law on which the Latin American trade mark law is based was created by the Crown of Spain for the protection of tobacco in all its forms, and was drawn up with only this in view, the king taking the attitude that those who did not protect their trade mark were not entitled to any consideration, the party first registering the trade mark having everything in his favor.

Register Your Trade Mark

As the attached table of costs for obtaining the registration of trade marks shows, the operation is not an expensive one when your goods are known and sold on the brand they bear, and we cannot too strongly advise the registration before selling goods in any of these countries.

At the present time there is a movement on foot which only lacks the approval of three nations to make the trade mark law in the western hemisphere a uniform one.

Under present conditions, a manufacturer to obtain his trade mark in these countries, must grant a full power of attorney to the person making the application to represent him in all negotiations to obtain the registration of his trade mark. Also another point of interest is that if you purchase a trade mark and do not record the transfer in the Government office for this purpose within 60 days, the sale becomes null and void and the trade mark remains the property of the person who previously had title.

In some of the countries the enforcing of the trade mark law and its interpretation is controlled by an organization similar to our local chambers of commerce, or commercial clubs and combined with the heads of the offices of patents and trade marks. Another form is seen in Costa Rica, where police authorities enforce the trade mark law, and in some cases have even forced a man to place a trade mark upon his goods.

It is interesting to note the broad view of what constitutes a trade mark—for example, names of manufacturers and business firms, their seals, stamps, engravings, vignettes, monograms, mottoes, legends or any other distinctive sign whatsoever, serving to identify the products of a manufacturer or the articles constituting the trade of commercial houses.

The offense of infringing on a trade mark is a penal one, besides the confiscation of the goods.

Nicaragua has the shortest trade mark law and appears in its penal code in articles 314 and 319, making a total of eight lines, but in this small space they accomplish a great deal. For example, he who forges a seal, stamp or mark of any party whatsoever, private, industrial or commercial, bank or individual, or makes use of forged seals, stamps or marks will be liable to imprisonment for one year and a fine of from $50 to $500. He who causes to be placed on an article of manufacture the name of a manufacturer who is not the maker thereof, or the commercial sign of a factory which is not the real factory, is liable to imprisonment of six months and a fine of from $50 to $500.

Registration Is Easy

There are a number of offices and patent and trade mark attorneys in the United States who are prepared to undertake the registration of trade marks throughout the world.

ARGENTINA.
Life—10 years; renewable.
Fees—$21.25.

BOLIVIA.
Life—Indefinite.
Tax of $1.95 per year.

BRAZIL.
Life—15 years; renewable.
Fees—$1.25 in stamps; renewal same.

CHILE.
Life—10 years; renewable.
Fees—$1.92; certificate $0.16; renewals the same.

COLOMBIA.—
Life—20 years; renewable.
Registration of trade mark $15; renewal $30.

COSTA RICA.
Life—15 years; renewable for periods of 10 years.
Fees—$7.90.

CUBA.
Life—15 years.
Fees—$12.50; renewal the same.

ECUADOR.
Life—20 years; renewable for periods of 15 years.
Fees—$19.19; renewal fees $13.34.

GUATEMALA.
Life—10 years; renewable.
Fees—$26.

HONDURAS.
Life—Indefinite.
Fees—None provided by law. Translation, publication and stamps $35 gold.

MEXICO.
Life—20 years; renewable.
Fees—5 pesos (Mexican currency is depreciating very rapidly).

NICARAGUA.—
Life—10 years; renewable.
Fees—$2.08; certificates $0.08 each.

PANAMA.
Life—10 years; renewable.
Fees—$25; renewal fee $20.

PARAGUAY.
Life—10 years; renewable.
Fees—$19.30; each extra certificate $0.13 with stamp tax $0.07 for first page and $0.15 for each additional page.

PERU.
Life—10 years; renewable.
Fees—$14.70. By applying for registration through the Peruvian Consul General a certain amount is saved in stamp fees.

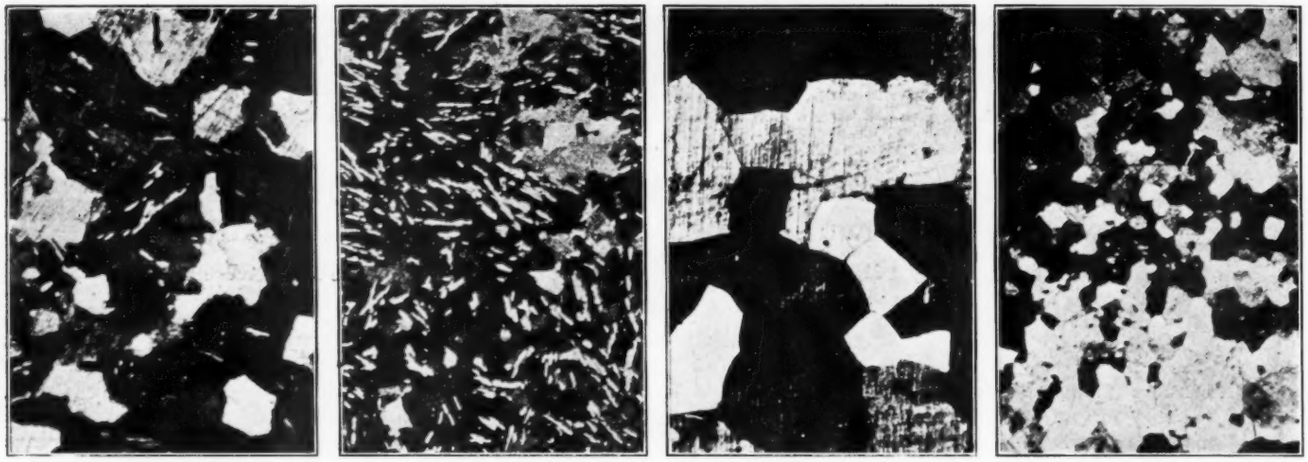
SALVADOR.
Life—20 years; renewable.
Fees—$3.63; annual tax on foreign trade marks $1.82; extra certificates $1.82; stamped paper from $0.04 to $0.10 per sheet. Ordinary paper may be used with stamps.

SANTO DOMINGO.
Life—10 to 20 years; renewable.
Fees—Registration for 10 years $5; 15 years $10; 20 years $15.

URUGUAY.
Life—10 years; renewable.
Fees—$10.34; renewal $25.85; extra certificates $2.07.

VENEZUELA.
Life—30 years; renewable.
Fees—$8.98.

*Further information can be secured from The United Export Bureau of THE AUTOMOBILE.



Bronzes of 59 per cent tin but different alloys: From left to right: 50 hrs. at 390 deg. cent., 100 hrs. at 310 deg. cent., 71 hrs. at 390 deg. and 100 hrs. at 310 deg.

Brass and Bronze—Offsprings of Copper—Part III

Alloying Substances Provide Metals Which Are Useful in Many Industrial Fields and Impart Widely Different Qualifications

By J. Edward Schipper

ALUMINUM is considered a lightening agent and yet when added to bronze in the proportion of 10 per cent to 90 per cent copper the resulting metal has a tensile strength up to 90,000 lb. to the square inch. Above this percentage of aluminum the alloy becomes brittle and no more than 11 per cent can be tolerated. It makes good small and medium castings, is readily worked, may be forged at a red heat and is quite ductile. It takes a fine polish and at one time was suggested as a good metal for U. S. coinage. One use to which it has been put is in the making of kettles for fruit preserving. It can even be made into small springs.

Nickel, in combination with copper, tin, antimony and lead, is much prized in the manufacture of the nickel-babbitts so-called, which are employed frequently for automobile motor bearings. It is a hardener and strengthener and it is put in the bearings to reduce their tendency to wear. The nickel which is added to the babbitt is the commercial grade and is generally about 98 per cent pure. It has about the same specific gravity as copper and hence does not greatly affect the weight of the given metal. Its influence on bronze is quite similar to its influence on steel in that it is a toughener. The impurities in nickel are iron, copper, silicon, sulphur, arsenic and carbon.

The metal known as white copper is a combination of copper and nickel. The United States 5-cent piece is made from a metal which contains 75 per cent copper to 25 per cent nickel. Copper, zinc and nickel go together to from German silver which has been used frequently in small parts for carbureter construction, wire in magnetos, ornaments, etc. The composition of German silver is generally copper 60, zinc 20 and nickel 20. In other words German silver is a brass when it belongs to the copper-zinc branch of the family. It has a tensile strength when cast which varies all the way from 24,000 to 46,000 lb. per sq. in. or higher. The results from thin sheets according to Kent give as high as 87,129 lb. per sq. in. The metal is known for the difficulties it presents to the foundry and rolling mill.

German silver can also be a bronze according to some authorities who give formulas which have a composition of copper, tin and nickel. According to others it is a Kalchoid, having both zinc and tin. The Chinese metal known as pakfong is made of copper, nickel and zinc and the bullet casings now in use in the European war are made from an alloy which is about 80 per cent copper to 20 per cent nickel.

Bismuth Toughens Bronze

Bismuth has a notable effect on bronze and although not used commercially to as great a degree as other alloying substances, it is recognized as a valuable toughener. It has been suggested that bismuth bronze be used for telegraph wires as these have to endure considerable stress, due to the wind. It is one of the component parts of the materials used for aluminum cooking utensils. If not carefully employed, however, and if the proportions are wrong the brittleness of the resulting metal is so great that it cannot be used commercially. When added to copper in a percentage of less 0.5 the alloy is ductile. Above that point the brittleness begins to show. One of the features of this metal is the fact that it reduces the electrical conductivity of the metals to which it is added. It has another peculiar property in that it is intensely diamagnetic, being repelled by a magnet.

Manganese is used in non-ferrous alloys where it is desirable to have castings of strength and toughness. This metal is valuable because of its strong affinity for oxygen with the result that it takes up the oxygen in castings and combines with it preventing it from forming bubbles of danger. It makes a casting homogenous, strong and ductile. Manganese bronze is one of the most useful non-ferrous metals in practical work but strange to say it is not a bronze at all, but a brass since it has as its root a composition of copper and zinc.

In appearance manganese bronze is similar to phosphor-bronze. It was invented by P. M. Parsons and was named by him white bronze. It is prepared by combining ferro-manganese in various proportions to copper and zinc alloys.

The ferro-manganese is first refined with particular care to have all the silicon removed and the iron content carefully regulated. In action the manganese bronze is similar to mild steel, having a tensile strength of about 60,000 to 90,000 lb. per sq. in. and an elongation in 2 in. of 20 per cent. This metal finds its great use in the manufacture of propellers for steam vessels. The great strength permits the blades to be made thin, and therefore efficiency of the propeller is not sacrificed. Besides this they do not corrode and are practically indestructible. While they cost about double the price of a steel propeller, the latter will have to be renewed about every three years, whereas the bronze propeller will be as good at the end of that time as it was at the beginning.

Manganese bronzes, of which there are many different grades are used also for resistance wire bearings, valves, piston rings and gun metal. When used for any purpose under water such as for pumps and for propeller blades it has to be carefully fitted so that galvanic action is not set up.

Silicon Bronze for Telegraph Wire

Silicon has its principal value when considered as an alloying substance in the manufacture of silicon bronze wire for telegraph purposes. It is about as strong as phosphor bronze but whereas phosphor bronze has a conductivity of only 26 per cent that of pure copper, the silicon bronze has a conductivity of 96 per cent that of copper, when specially prepared with a view of obtaining maximum conductivity. In ordinary practice for telephone wires the conductivity of the silicon bronze is about 70 per cent that of copper. The wire has great tenacity and is a resister of corrosion. It is practically as strong as steel which has been used for the purpose and need only be approximately one-half the diameter to carry the same amount of current as the ordinary steel telephone wire of 0.08 in. diameter can be replaced by silicon bronze wires of 0.04-in. diameter. The tensile strength of silicon wire, 3 per cent silicon and 97 per cent copper is about 55,000 lb. per sq. in. cast. With that strength a wire 0.08 in. diameter would be able to sustain its own weight to a length of 13.8 miles. A bar of steel of 90,000 lb. per sq. in. tensile strength having a sectional area of 1 sq. in. can sustain its own weight for a length of approximately ½ mile.

Iron enters into the brass and bronze alloys at times but is of little value as compared to other substances. In fact it is an impurity in most instances. It is found in manganese bronze because the manganese is added in the form of ferro-manganese. It is found in the gear bronzes at times when iron is added up to as high as 4 per cent, to act in the nature of a hardener. In this respect it gives good results and is accepted as standard practice.

While the alloying substances mentioned are those most frequently used in the arts and sciences, there are several others which are used in secret formulas and for special purposes which are not general enough in their nature to be discussed here. The alloying substances themselves are combined quite frequently, the mother metal copper in these cases being omitted.

Many manufacturers of metal have adopted a pet formula which they have kept secret and these metals are generally sold under a trade name. This is true of casting and forging metals for such purposes as propellers, bearing liners and other specific purposes. Indefinite compositions also have been given names which are generally used. Some of these are tobin bronze, bell metal, admiralty metal, Muntz metal, high brass, cartridge brass, German silver, gun metal, art bronze, gold bronze, delta metal, and many others.

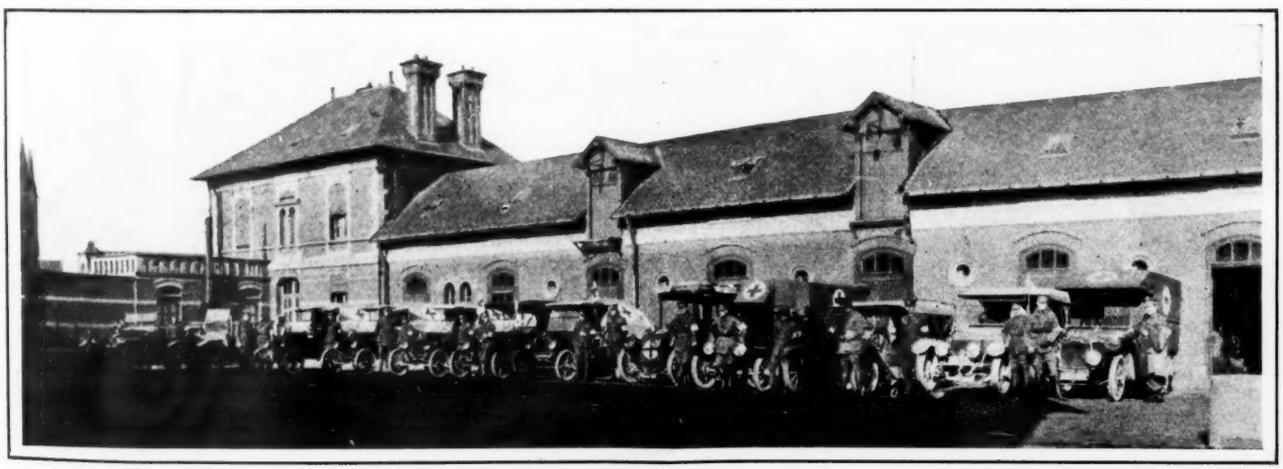
Many Family Branches

These are the main branches upon which are hung the offshoots of the non-ferrous family tree. Like a tree with copper as the trunk and two main branches called brass and bronze, there are offshoots from these branches which are quite separate from the trunk as far as physical qualities and uses are concerned. The complexities of the inter-relationship of the different metals which compose the family are so vast that the study of centuries has not yet evolved the situation to one where practice is standard. In fact the newer art of iron and steel alloying has far surpassed the older one of brass and bronze as far as the standardization of practice is concerned.

The reason for this is not far to seek. It lies in the fact that the heat treatment of iron and steel can be depended upon to give a definite result, provided the materials are put into the mixture in the desired proportions. In bronze work for example, there are several well-known instances where the order of placing the materials into the crucible has such an effect upon the resulting metal that the qualities of two metals mixed in different ways are entirely at variance with each other. Heat treatment cannot be called to the help of the mixer of brasses and bronzes to anything like the degree to which it is in steel work. While it is true that heat treatment will never make a good steel out of a poor mixture, it is a fact that a good mixture can be brought to its state of best usefulness by skillful manipulation of the furnace.

The End.

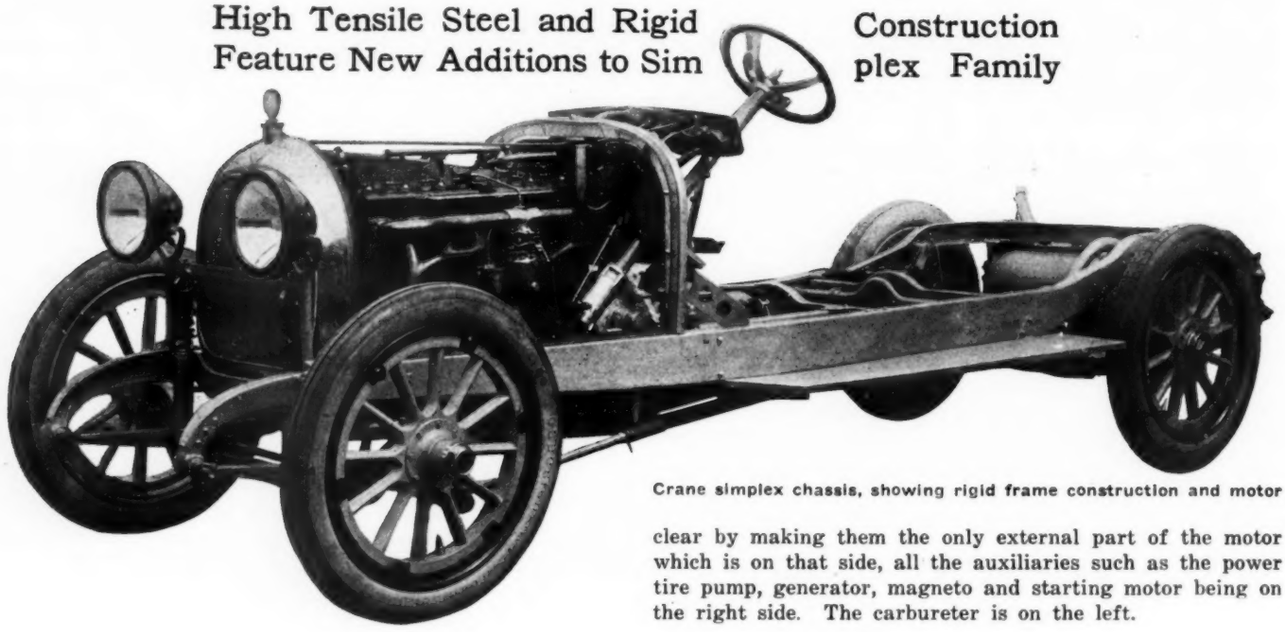
Some of the Cars of the American Ambulance Corps in France



Lined up before the hospital building which cares for the several hundred wounded brought in every week from the front by the cars. From a photograph contributed by Eliot Norton, Esq., New York City

Crane-Simplex a High Power Design

High Tensile Steel and Rigid Construction Feature New Additions to Simplex Family



Crane simplex chassis, showing rigid frame construction and motor

WHEN Henry M. Crane, former president of the Crane Motor Car Co., of Bayonne, N. J., builders of what has been known as the highest-priced chassis in America joined the ranks of the Simplex company last fall, it was expected that a product of special engineering interest would be evolved, due to the fact that cost has been made a secondary consideration throughout for the best possible in material and design. The Crane model Simplex is now being actively marketed and its chassis price of $5,000 indicates that it is designed to meet the tastes of those who prefer practically custom made cars.

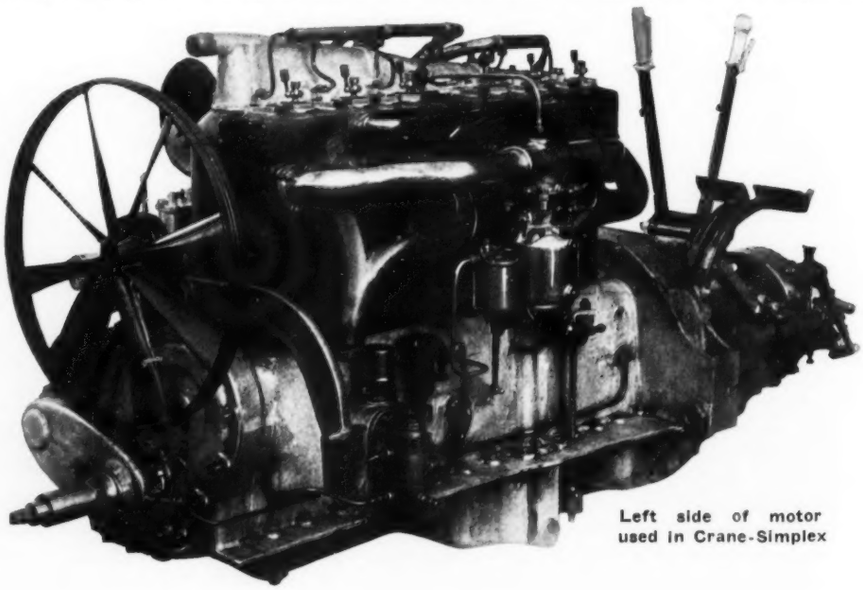
A general survey of the chassis does not show any features of design which can be called radical. The impression of great sturdiness and strength is given rather than one of freakish design. In a word, it is a large, solidly-constructed car, in which the subject of material has been given a special amount of attention and in which the details have been worked out carefully from the viewpoint of long life and accessibility. One of the features of the sales end of the car, is that it is guaranteed for life so long as it remains in the hands of the original purchaser.

The specifications of the standard chassis include a wheelbase of 143½ in. with 36 by 4½ front and 37 by 5 rear tires, and a standard tread of 56½ in. The power plant is a combined unit of six cylinders, disk clutch and four-speed gearset mounted with three-point suspension. The flywheel housing has two of the supports in a unit with it, and a third point is at the center of the cross member at the front of the radiator. The cylinders are cast in two blocks of three, with the head integral and with both the exhaust and intake on the left side. In fact, it has been made a special point to keep the valves free and clear by making them the only external part of the motor which is on that side, all the auxiliaries such as the power tire pump, generator, magneto and starting motor being on the right side. The carbureter is on the left.

100 Hp. at 1800 R.p.m.

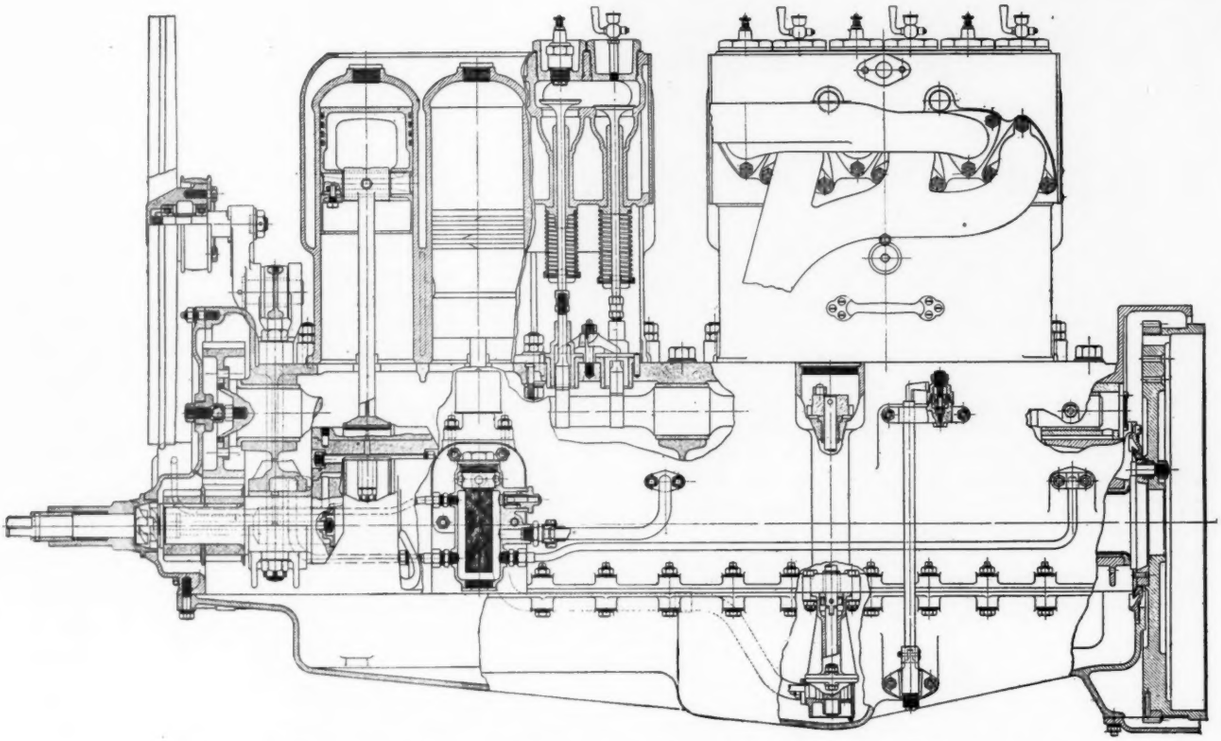
With a bore of 4⅜ and a stroke of 6¼ in. the motor develops in excess of 100 hp. at a speed of from 1800 to 2000 r.p.m. The valves are 1¾ in. diameter, in the clear and the design throughout is not one which would imply an extremely high-speed motor but rather one of medium speeds. The gear reduction at the rear axle on the standard models is 3 to 1 and the motor has been found powerful enough to handle cars weighing in the neighborhood of 5000 lb. on all ordinary grades and in all ordinary country at this ratio.

The crankshaft is very rigid. It is of electric furnace alloy steel, oil hardened, and is carried on three main bearings. The bearing diameters are 2¾ in. with both the main and crankpin bearings lined with white bearing metal in harder bronze shells. The caps for the main bearings are steel forgings fitted into the aluminum crankcase and held in place

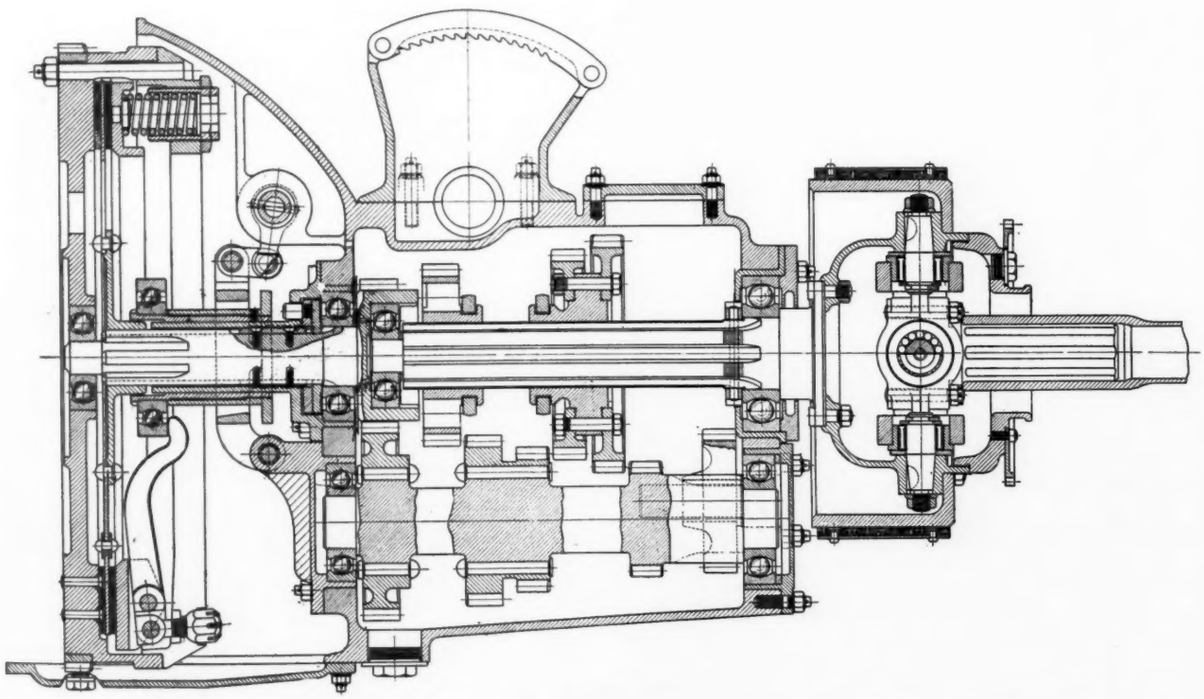


Left side of motor used in Crane-Simplex

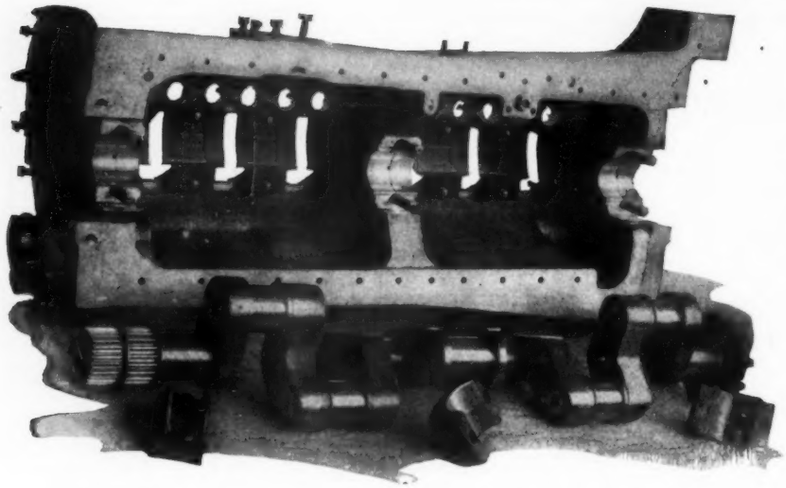
Sections of Crane-Simplex Motor and Gearset



Part section of Crane-Simplex six-cylinder motor, showing details of cylinder, piston and valve construction and bringing out the arrangement of waterjacketing and manifold details



Section through the gearset and universal, showing the transmission brake and also details of the clutch mechanism. As will be noted, the clutch has a single driving disk between two fabric-faced plates. The gearset is full ball bearing mounted and the universal is housed within the brake drum



Crankcase and crankshaft of the Crane-Simplex six-cylinder motor

by heavy bolts which pass entirely through the crankcase. I-beam connecting-rods which are machined on all sides for lightness are employed, the machining not only taking off the excess material but forming an excellent method for detecting poor forgings. The connecting-rods are not only balanced as regards weight, but the centers of gravity of each are determined carefully and precautions taken to have the centers of each set of connecting-rods at an equal distance from the crankpin axis.

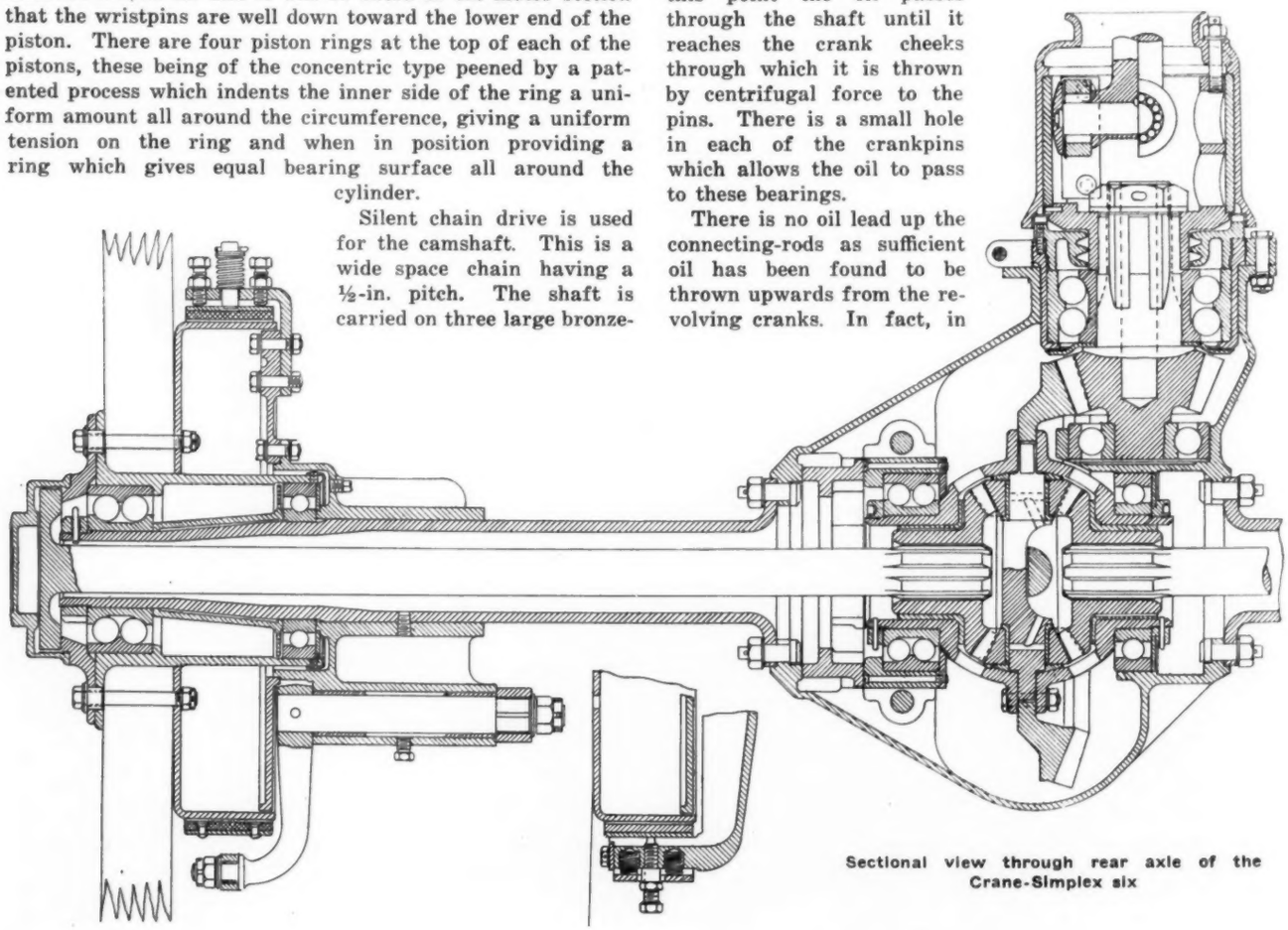
Pistons 6 1/16-In. Long.

A feature of the motor is the length of the pistons. These measure 6 1/16 in. and it will be noted in the motor section that the wristpins are well down toward the lower end of the piston. There are four piston rings at the top of each of the pistons, these being of the concentric type peened by a patented process which indents the inner side of the ring a uniform amount all around the circumference, giving a uniform tension on the ring and when in position providing a ring which gives equal bearing surface all around the cylinder.

Silent chain drive is used for the camshaft. This is a wide space chain having a ½-in. pitch. The shaft is carried on three large bronze-lined bearings which are so arranged as to allow the removal of the camshaft through the front of the case. The cams, which are integral with the shaft, are of the tangent type and work against followers which are of a special design so arranged that they provide the equivalent of a 4-in. roller follower, although they are solid. These lifters combine the advantages of the solid lifter with that of the roller type and allow a steep cam which at the same time is not unduly noisy.

Oiling is by pressure feed and the lubricant is carried positively from a gear pump operated by special drive from the camshaft from the oil reservoir in the lower half of the crankcase to a distributer housing mounted in an accessible position on the left side of the crankcase. This distributer has a large strainer through which the oil first passes, and an overflow valve which acts as a by-pass pressure regulator keeping about 10 lb. pressure on the system at all but low engine speeds. There are three leads from the distributer, each one going to a main bearing and carrying the oil directly to these under pressure. In addition to these three leads there is a smaller one which carries oil to the silent chain camshaft drive. In order that the driver shall be at all times aware of the condition of the oiling system there is an independent lead which passes to the cowl board and operates a pressure gage. From the main bearing, the oil passes through a hollow crankshaft, the oil entering from the main bearing to four large holes drilled into the shaft. The pressure on the oil is ample to overcome the centrifugal force at the exterior of the shaft and from this point the oil passes through the shaft until it reaches the crank cheeks through which it is thrown by centrifugal force to the pins. There is a small hole in each of the crankpins which allows the oil to pass to these bearings.

There is no oil lead up the connecting-rods as sufficient oil has been found to be thrown upwards from the revolving cranks. In fact, in



Sectional view through rear axle of the Crane-Simplex six

order to prevent an excessive supply of oil, baffle plates have been introduced between the cylinders and the crankcase which allow the connecting-rods to work only through comparatively narrow slots. After the oil has been forced through the system, it drains back into the crankcase and thence back to the reservoir of the lower half whence it is again pumped into the system after being drained.

Twin Exhaust System

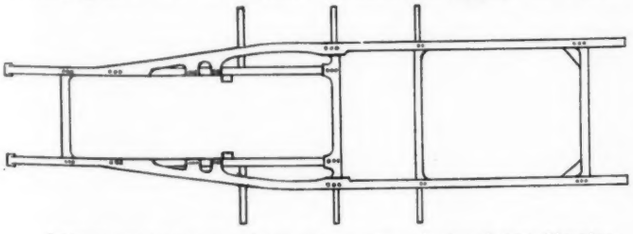
In order to cut down any possibility of back pressure, due to overlapping explosions, a twin exhaust system is used, each block of three cylinders exhausting into a separate manifold. The pipes are carried down at the front end of each block and then curved back and carried straight to the muffler. This gives a compact manifold design which is so arranged as to get the hot gases away from the motor as quickly as possible. The intake is quite compact and both the pipe itself and the carbureter, which is a Newcomb modified slightly to conform with Crane requirements, are waterjacketed. These manifolds and the valves are the only things carried on the left side of the motor. On the right side are the auxiliaries and below the manifolds on the left, are the removable cover plates which permit of easy and accessible valve adjustment.

One saw steel disk is used in the clutch which is built into the flywheel casting. This steel disk is carried on a splined shaft leading to the gearbox and is mounted between two Multi-bestos rings, one of which is riveted to the flywheel and the other to a heavy ring which forms the driven member and which is pressed against the steel disk by means of twelve spiral springs. Since the clutch is continually kept in an oily condition it is necessary, in order to maintain a positive drive without slip, to have unusually strong springs and to accommodate these and at the same time render it easy for the driver to remove the clutch, care is taken to provide a strong leverage in the pedal arrangement.

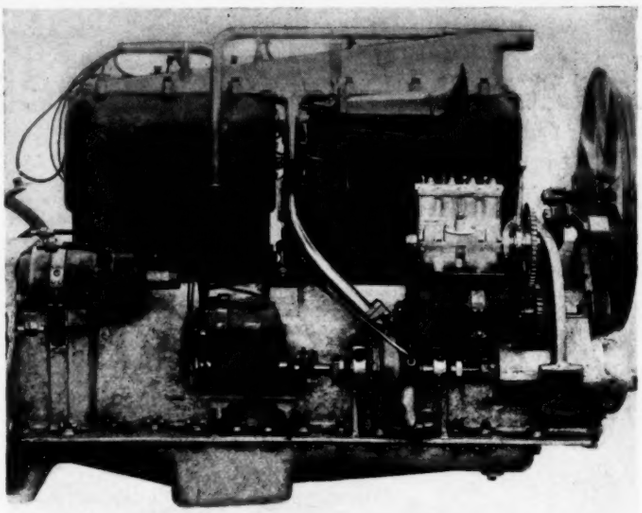
Four-Speed Gearset

Extending back from the rear of the motor is a bell-shaped extension, which forms a housing for the flywheel and clutch and also the forward end of the gearbox. The latter contains a gearset which provides four forward speeds. The countershaft is below the main shaft and both are mounted on annular ball bearings. The reverse idler is fitted with a bronze bushing and runs on a stationary shaft of large diameter. The materials used in the gears and shaft are electric furnace products of great strength and durability. Center control is used and to provide the utmost simplicity the gearshifter gate is mounted directly upon the gearcase, bringing the shifter lever and the emergency brake lever in the center of the car. Heavy oil is used in the gearbox and there is an oilproof housing between the gearset and the clutch to prevent any leakage of oil from the gearset into the clutch.

Hotchkiss final drive is employed in connection with a floating axle in which special attention has been given to securing a wide bearing spread for rigidity while at the same time all the load is borne on the axle tubes. The shafts are high-tensile alloy steel and the tubes are nickel steel bolted to a central cast-steel housing. This has an exceptionally large removable cover which renders accessible the rear axle driving gears which can be removed through this opening. The driving gears are of electric furnace alloy steel of spiral



Layout of frame members of the six-cylinder Crane-Simplex



Right side of motor showing starter, magneto, generator and power tire pump mountings

bevel form and are carried on a double row ball-bearing in front of the pinion and a single row behind. The large gear is mounted on the differential which is a four-pinion design carried on annular ball bearings. The bearing arrangements at the outside ends of the axle tubes are so arranged by turning the hub inward that the axle is considerably shortened, giving a saving of weight and also an increase in rigidity. The wheel is carried on a double row ball-bearing mounted directly on the center line of the hub and a single ball is located at the inner side.

Service Brake on Driveshaft

The service brake is carried on the driveshaft and the hand brake on the rear wheels. The drum diameter of the hand brake is 14 in. and the face width, 2½. Adjustment on these brakes is provided by a nut at each wheel. The service brake which is mounted on the propeller shaft just back of the gearbox is a contracting band design lined with Multibestos having a drum diameter of 10½ in. and a face width of 4 in.

An I-beam section front axle, which is so arranged at the knuckles that the wheels pivot at the point of contact between the tire and the road, is employed. Since the axle and knuckles are of electric furnace alloy steel they can be made of comparatively light section. The knuckle pin is fitted in bronze bushings and the load is carried on hardened washers bearing against the bushings. The hubs are forged steel and are equipped with roller bearings supplied with grease plugs which can be removed by refilling the hub caps. The spring clips are of alloy steel and the steering rod connections are ball and socket type with extra large bearing surface. All the moving parts of this linkage are packed in grease and covered with leather boots.

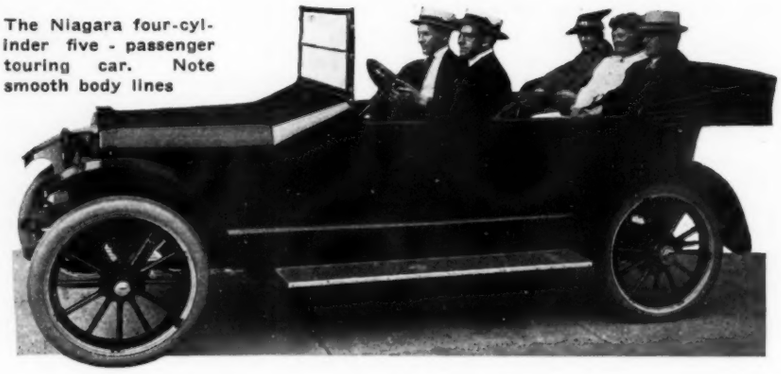
Narrow Turning Radius

Heat-treated alloy steel is used in the construction of the frame, which is of interest. The frame is but 30 in. wide in front, the width increasing back of the motor to 44 in. This permits of a very narrow turning radius. The great width of the frame under the body allows a light construction, but the arrangement of the subframe in front makes the structure particularly rigid for half the length of the frame. Beyond this point it is braced by double cross members. The depth of the flange of the side members is 6½ in. and the running boards are attached directly to the lower flange of the channel side members. This avoids the use of splash

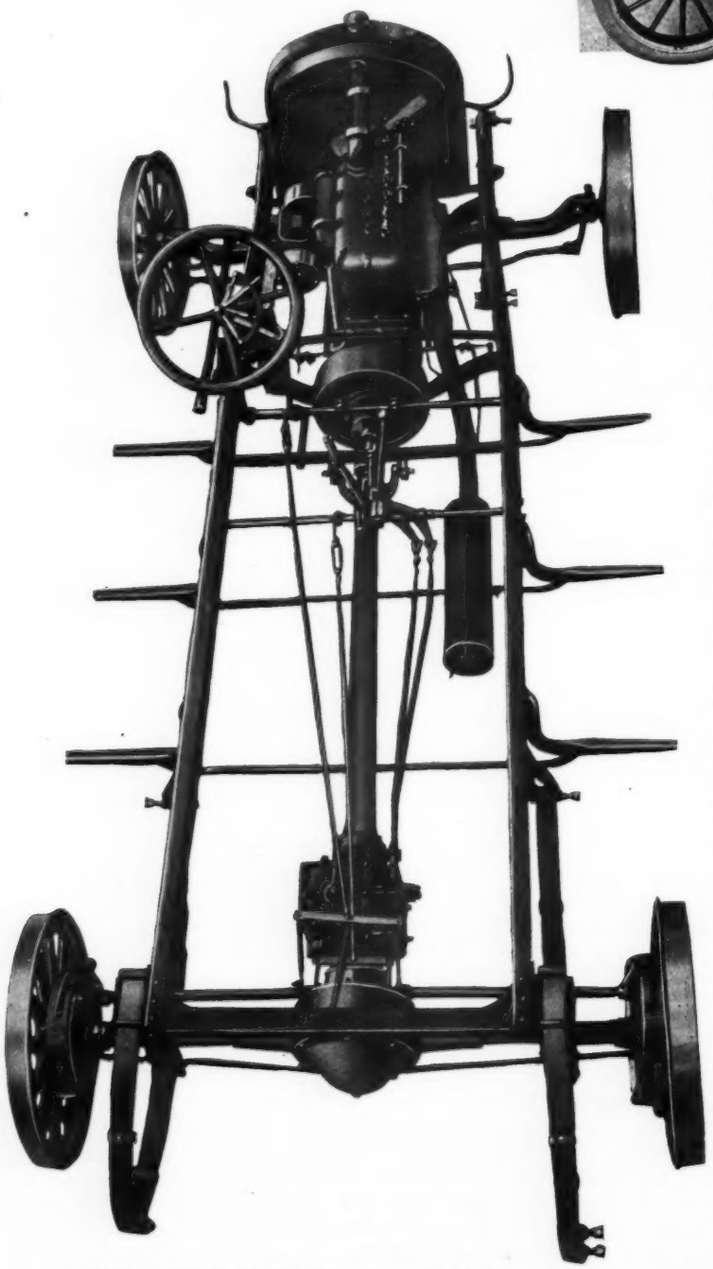
(*Continued on page* 419)

European Touches in Niagara Four

High-Speed 3½ by 5 Block Motor—Detachable Cylinder Head—Ample Bearings and Rigid Assembly—Sells for $740



The Niagara four-cylinder five - passenger touring car. Note smooth body lines



Chassis layout of the Niagara four-cylinder car, showing left drive and center control and mounting of the gearbox at the rear axle

DETAILS of the Niagara Four, which, as was announced in THE AUTOMOBILE for August 26, is to be built by the Niagara Automobile Co., Buffalo, N. Y., bring to light the fact that the design follows European tendencies in a great many respects. The power plant, which has a nominal rating of 36 hp. is of the high-efficiency, high-speed type with the four cylinders cast in a single block. The bore and stroke are 3½ by 5, and in exterior appearance everything has been done to maintain up-to-date cleanness of design. The valve chambers are entirely waterjacketed, and below the jacketing the valves are inclosed.

Detachable Cylinder Head

In accordance with what is rapidly becoming universal practice, the cylinders and heads are cast separately, allowing for good casting work and permitting the manufacturers to use large valves and to assure themselves of good core setting in the casting. The cylinder heads are held in place by heat-treated nickel-steel bolts which give a tight fit to the head and allow the copper-asbestos gasket between the cylinder and head castings to be tightly compressed, thereby preventing any leakage.

Three-ring pistons are employed and care is taken in the piston and connecting-rod assembly to maintain as near perfect as possible reciprocating and rotary balance. The centers of gravity of the individual pieces are carefully located as well as every assembly. In construction the upper end of the connecting-rod is fitted with bronze bushings. The rods themselves are drop-forged and are of the conventional I-beam design.

Three bearings are used for the crankshaft. These bearings are of sufficient length to guard against whipping tendencies, and the flywheel is rigidly bolted directly to the crankshaft by means of a flange on the rear end. The material of the crankshaft is carbon steel, heat-treated for rigidity and with ample diameter, bearing space and physical characteristics makes up a solid unit.

Lubrication is practically self-contained in the aluminum crankcase, the upper half of which forms the engine bed, and the lower half containing the oil pan and lubrication system. The method of circulating the oil is a plunger pump operated from an eccentric on the camshaft. This pump forces the oil through direct leads to the bearing surfaces in the crankcase, and by its action maintains a series of troughs full of oil below the connecting-rods. On the bottoms of the connecting-rods there are oil scoops which complete the circulation system for the lubricant. The excess oil drains back to the oil pan where it is strained and again passes through the system.

Cooling is through a honeycomb oval radiator and carburetion is effected by a Zenith instrument which is supplied with gasoline by a gravity tank located in the cowl.

The Electrical System

From an electrical standpoint the car is fully equipped, having a Disco motor-generator system for lighting and starting, operating through a positive drive silent chain which is completely inclosed. For ignition, there is a Remy distributer system which is operated from the Willard storage battery that is constantly kept charged by the generator. The starter is operated by a push button on the toeboard and is capable of spinning the engine under normal conditions at 125 r.p.m.

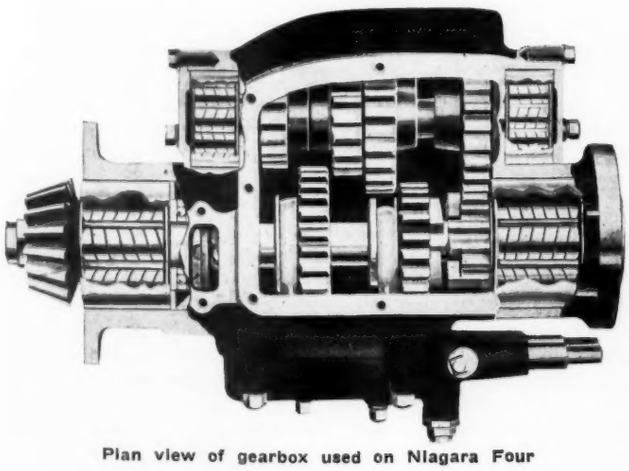
A multiple disk clutch is used in conjunction with a three-speed selective gearset integral with the rear axle. All the gears are made from chrome nickel steel and are carried on Hyatt high-duty roller bearings. The rear axle is floating and is contained in a 2¼-in. steel housing. The driveshafts which take only the propulsion torque are 1⅛ chrome nickel steel. The gears are the product of the Brown-Lipe Co., the bevel drive pinion and ring gear being 3½ per cent nickel steel. The axles are supported by a truss rod.

Drop forged I-beams are used for the front axles, the steering knuckles being Elliott type and the bearings cup and cone ball design. Artillery type wheels equipped with 32 by 3½ tires with twelve oval 1½-in. spokes and demountable rims with an extra rim comprise the wheel equipment. The springs are semi-elliptic front and three-quarter elliptic rear, the lower half of the latter being 44 in. in length with the upper or scroll part 20 in. long, measured from the center of the spring shackle to the point of support. The springs transmit the drive and in order to provide sufficient material to take this strain the width of 1¾ in. is used with a rear shackle and a fixed front support.

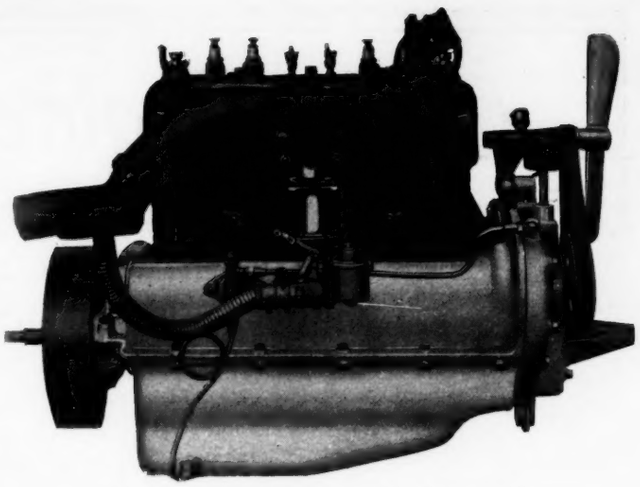
Brakes Are Double

The brakes are double with contracting service and expanding emergency on rear axle drum. Drum diameter is 11 in. The frame is pressed steel channel section 4 by 1½ by 5/32 in. with three cross members tapered from 32 in. at rear to 28 in. front. The wheelbase is 112 in. and the road clearance 11 in. Standard tread of 56 in. is employed.

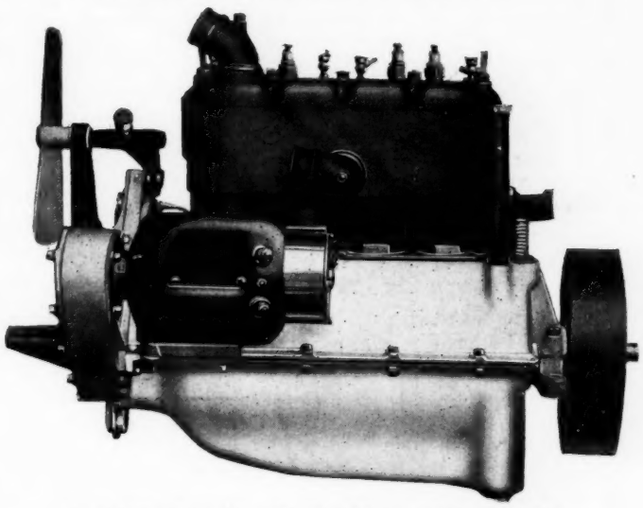
In the way of body work, the Niagara provides a yacht-line five-passenger body which is up to date in protective upholstering and coach work. The door hinges are invisible, instruments mounted on the cowl board and the storage battery carried beneath the front seat. The framework of the body is of first grade white ash with all joints mortised, screwed and glued. The steel coverings are of 18 gage polished nickel steel sheeting. Complete equipment is sold with the car, which markets for $740 f.o.b. Buffalo, N. Y.



Plan view of gearbox used on Niagara Four



Manifold side of motor used in Niagara car



Left side of engine, showing Disco motor-generator

Crane-Simplex a High-Power Design

(*Continued from page* 417)

guards and goes to make up a quiet assembly. For the engine support, there is a sub-frame made up of two deep channel members which are fitted to side members at the front end, and to a cross member at the rear. Suspension is by semi-elliptic springs all around, the rear being 62 in. in length and forming a unit of the Hotchkiss drive, taking both torque and drive. The rear spring support is by ball and socket connection, giving an exceptional flexibility at this point.

Steering is by worm and full gear, both the worm and gear being hardened steel and the wormshaft being fitted with thrust bearings. The gears are inclosed and operate in heavy oil.

In the fitting and equipment of the chassis, everything has been done to promote reliability and long life. Throughout, wherever possible, bushings take the wear to avoid the possibility of having to purchase expensive parts when a bushing replacement will do. Starting and lighting is by the Rushmore system and for ignition a high-tension dual outfit is supplied. The radiator is a cellular patented design carried on a cross member over the front axle. It is cooled by a 21-in. aluminum fan. The lines of the radiator are carried to the hood and cowl and hood clamps which provide against the possibility of rattle ever developing are fitted. Yale locks are supplied on each side of the hood and the cowl board is fastened to the dash and is independent of the body and cowl. The instruments on the cowl board are complete.

The Engineers' Forum

Thinks Aluminum Piston Will Never Prove Success in Truly High-Duty Motor—Weight and Endurance —Believes Aluminum Is Not Stronger Than Cast Iron

By Finley Robertson Porter,
Finley Robertson Porter Co., Inc.

PORT JEFFERSON STATION, L. I., Editor THE AUTOMOBILE:—I have read with a great deal of interest the exceptions taken to my remarks last week in reference to the universal use of aluminum in the automobile by both A. L. Clayden of THE AUTOMOBILE and J. E. Diamond, of the Aluminum Castings Co. Mr. Clayden's remarks in reference to crankcases and gearboxes is absolutely correct, and in my former article I should have mentioned the fact perhaps that these two units are, as Mr. Clayden explained, a case where rigidity is the main object and aluminum is to my mind the most acceptable material to be employed.

Inasmuch as this practice has become so general, it did not occur to me that these points were at issue and I based my remarks on other essential parts, feeling that the question of these two units was never involved.

In view of the discussion becoming as broad as it has I will concede that aluminum is without doubt the best material to be employed in these two cases.

Taking up the matter of pistons, however, I still feel that an aluminum piston will never prove a success in a truly high-duty motor. I mean by this, one that will develop at least a horsepower for every 2 cu. in. of displacement. I feel most certain that the motor of 1917 that will be recognized as a standard in the better class of automobiles, will have to prove sufficient for five- and seven-passenger touring cars, with a displacement not to exceed 200 cu. in. To attain this efficiency it means that a greater percentage of the heat generated will have to be dissipated by energy produced at the driving wheel rather than through a waterjacket or whatever cooling medium is employed.

Heat Conductivity Value

My contention in reference to the aluminum piston is that its great heat conductivity is of no real value because of the fact that the piston clearance and film of oil so thoroughly insulates the transmission of heat to the waterjacket that it becomes only a question of transferring the heat from the head of the piston to the side walls quickly enough to allow it to flow through the wall contact at the best possible rate. I believe it is conceded that cooling by radiation from the inside of the piston is a very negligible quantity since there has been no way as yet devised that permits of introducing air enough at this point to become a factor.

If this theory is correct, we can eliminate the conductivity of aluminum as a factor in its favor and confine ourselves principally to the question of weight and endurance. In view of the conditions mentioned, the temperature of a piston in a motor of this type must necessarily be very high when working under a full load, which we must remember is only a small percentage of the time, but in view of the fact that these extreme conditions do exist, they must be cared for in design with the result that an aluminum piston can be figured at scarcely more than 8000 or 10,000 lb. to the inch, inasmuch as these extreme temperatures may reach as high as 800 to 900 deg., which means that aluminum at that point has very little resistance, while in the case of cast iron we can assume a safe working stress of at least 25,000 lb. to the inch at these temperatures, and in the case of steel this factor can be safely considered as high as 60,000 lb. for cast steel and up to 175,000 lb. when the higher grade of forged steel is employed.

Inasmuch as the future motor will without doubt be confined to bores not to exceed 3 in., the question of section needed to conduct the heat away from the head of the piston comes to a point where steel can easily be employed, based almost entirely on the question of strength.

High Expansion Coefficient

My great difficulty, however, with aluminum pistons has been the high coefficient of expansion. Coming back again to the extreme heat conditions that prevail in a motor at times, it necessitates clearance enough to take care of this, which means that about 80 per cent of the time the motor is working with very loose pistons, which not only produces a piston slap but has a great tendency to break rings and produces a great deal of wear in the ring grooves which in a very short time becomes a source of trouble.

Referring to Mr. Diamond's remarks, I concede that aluminum is not one-third lighter than steel or cast iron but is rather one-third its weight. This is purely an error on my part and I stand corrected.

I do not concede, however, his statement that aluminum is stronger than ordinary cast iron, and I believe his assumption of 20,000 lb., tensile strength for aluminum is very low. It surely is, if it is supposed to surpass cast iron in strength. I have no difficulty in getting cast iron to run as high as 38,000 lb. tensile and have never heard of any aluminum concern claiming more than 32,000 or 33,000 tensile strength for aluminum. At the same time admitting that it is very far from uniform, so that a safe working factor must be accepted far below this figure.

280,000 Tensile for Steel

His statement also in reference to the strength of steel is far below what I would consider correct. The steel that I am using in motors for such parts as crankshafts, camshafts, bolts and nuts we are getting as high as 280,000 tensile.

Mr. Diamond's contention that my granting an improvement in the case of a low-priced automobile should also apply to a high-priced one I believe is a mistake, and in the matter of two designers being given free hand, one confined to aluminum and iron and mild steel and the other to the use of steels, is no doubt occasioned by my omitting to men-

tion that for crankcases and gearcases I felt that aluminum was so generally accepted that it would not be under discussion.

In the matter of the difference of expansion between aluminum, iron and steel as being prohibitive to the employment of inserted sleeves, I still differ with Mr. Diamond, but careful consideration of my view on this point as expressed in your last issue, will disclose the fact that I modified my statement in reference to this type of construction to the extent that I conceded the method possible, but was under the impression that it would require considerable experimenting to determine its feasibility.

All discussion in reference to this subject could be made much more valuable and instructive if we could first determine just what is considered a commercial job.

My impression of the matter is that it simply means the elimination of useless expenditures for material and methods not consistent with the results obtained. I do not believe the question as to whether an automobile costs $1,000 or whether it costs $3,000 should enter into the argument because of the fact that an engineering problem I believe should be based entirely on results obtained and not on any one intermediate condition that might be adopted by the different manufacturers. I believe we should consider the best possible results leaving the question of price out of it.—FINLEY R. PORTER, Finley Robertson Porter, Inc.

Predicts Adoption of Aluminum Pistons as Standard by Majority of Cars—System of Ribbing Strengthens Dome

By Walker M. Levett,
Walker M. Levett Co.

NEW YORK CITY—Editor THE AUTOMOBILE:—I have followed with deep interest your symposium on the use of aluminum alloys in automobile construction. Inasmuch as our company was the first in the aluminum piston field and has been manufacturing aluminum alloy pistons of very many varied types for upward of four years, in the automobile, marine and aeroplane fields, having been concerned with the designing of some and having cast all the magnesium-aluminum alloy pistons used in the well known racing cars of the last three years, in addition to having cast numerous other magnalium and aluminum alloy parts for automobiles, I have been particularly interested in that part of the discussion relating to engine design and piston. In replying to some of the comments that have been made, my attitude is simply that of one offering the benefits of observation accrued through experience as an aid or guide for some of those who have not had the same interesting opportunities that have arisen in what is, so far as I know, the greatest and undoubtedly the most diversified experience in casting aluminum alloy pistons.

A Mistaken Attitude

F. R. Porter's contribution in particular proved interesting to me as he portrayed a situation which we are now meeting almost daily, in view of the rapidly growing interest in aluminum and its alloys for engine requirements. With all due deference to Mr. Porter and his unquestionable attainments, there is not the slightest doubt in my mind that he "rushed into print" on the matter of aluminum alloy pistons, without having given them the thorough work-out which the ultimate benefits derived by those who have done so would warrant. Mr. Porter's attitude unfortunately is one that may be found among a good many clever automobile engineers. That it is a mistaken stand is best proved by the fact that aluminum pistons are being used with a remarkable degree of success for standard production in some of the best known cars for 1916 with the likelihood of their being adopted as standard by a vast majority of cars in the following year.

It is solely with the motive of aiding other engineers who, against their own conviction possibly, realize that the day of the aluminum piston has arrived, and that of the iron piston is on the wane, that I am taking this opportunity of stating a few concrete facts, both as to successes and failures in experimental work with aluminum pistons and aluminum cylinders.

The distinct impression gained after some years' experience along these lines is that each engine offers an individual problem as to clearance and prevention of slap. The engineering rules relating to coefficient of expansion seem to strike a snag when applied to two pistons of the same dimensions used in different type of engines, owing to the differing cooling properties of each type. I could give off-hand a number of rules for clearances that are proving perfectly satisfactory in different types of engines and ranging all the way on the skirt from 0.00125 in. per in. of piston diameter to 0.00275 in. per in. of diameter and without the slightest indications of slap or undue wear in either case. On the other hand, I have known of experimental work where the ordinarily safe rule of doubling the clearance usually allowed for cast iron pistons failed to operate and permitted a very appreciable slap. The manufacturer in whose engine this occurred persisted, however, until he arrived at a satisfactory clearance and has adapted our Magnalite pistons for his standard production.

With regard to the slap which is noticed when the engine is cold and too much clearance has been permitted, there have been numerous methods devised to overcome this usually objectionable feature and with evident satisfaction. Offsetting the wristpin 1/32 in. seems to have satisfactorily solved the slap problem for one manufacturer. Adding ¾ in. to the length of the skirt is a solution by another. A four segment split in the skirt of the piston and machining the skirt to an almost exact fit with the cylinder wall has also prevented any play and consequent slap for another manufacturer. Numerous counter-balancing weight distribution methods also have been employed with success.

Experience with Magnalite Pistons

The matter of the initial slap where objectionable is therefore adequately taken care of by methods that were gained solely through experience. The matter of clearance is one which warrants a little experimental work for each engine in which Magnalite pistons are to be used and the results fully justify the effort. Space limitations prevent my giving full details of numerous interesting experiences with Magnalite pistons that have come with long association with this metal. I will state for Mr. Porter's benefit, however, that we recently shipped abroad pistons on an order from one of the best known concerns, who apparently has been in the fortunate position of being able to disregard costs. This concern formerly had employed pistons which were machined from solid steel billets. Their instructions to us were practically *carte blanche*—to produce a lighter-than-steel piston, which would stand up under the heavy stresses of their high-speed motor.

(*Continued on page* 447)

Sham Warfare Motor Equipment Test

Right—Part of the military instruction camp at Plattsburg pitched in a sheltering wood

Left—Mack 3½-ton truck pulling field gun and limber on way to Plattsburg camp

By J. Edward Schipper

MILITARY Instruction Camp, Plattsburg, N. Y., Aug. 29—What an automobile machine gun corps can do in time of action was clearly demonstrated today in an engagement which took place here between the red and blue armies made up of units from the military instruction camp. The machine gun corps which is attached to the red, or invading army, and is under the command of Captain Smedburg, machine gun expert of the U. S. Army, in connection with the second U. S. Cavalry, succeeded in capturing the entire Thirtieth U. S. Infantry, one of the principal units of the blue defending army and one of the crack organizations of the regular army.

The action centered about the Coopersville, N. Y., bridge over the Big Chazy River. Late Saturday night the blue army scouts captured this bridge. Reinforcements arrived and were ordered to hold the bridge against any attacking force. Captain Root of the Thirtieth U. S. Infantry marched on the bridge early this morning and found it in possession of the blue scouts with its reinforcements. Although the red army scouts reported that other than the force holding the bridge the field was clear, a host of blues was concealed in the brush and shrubs nearby awaiting the order to surprise the crack regiment of reds. Everything had been arranged for a successful ambush of the unsuspecting blues. About a mile to the north of the bridge the machine gun troop, in its armored cars, was waiting on the State road ready to rush to the support of the attacking reds, and when everything was ready the reds hopped up from every side, completely surrounding the regiment of blues, who tried in vain to re-form their line to resist the attack.

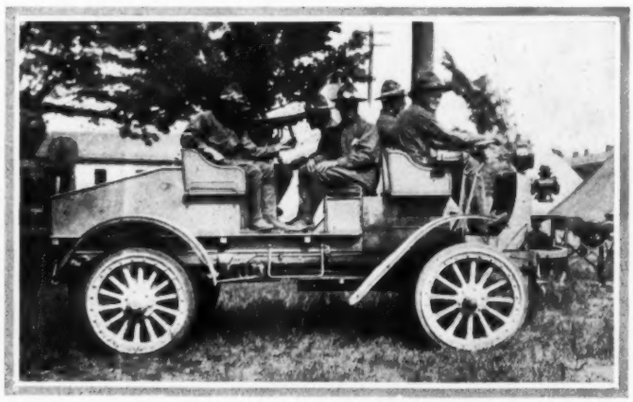
Armored Cars in Action

The final stroke was delivered when the whole battery of armored machine gun cars dashed down the State road into the very midst of the trapped blue regiment and the umpires ruled that the entire organization was captured; or rather, that its survivors were. The machine gun troop has shown that it has justified every claim for mobility. Dashing down the road at 30 m.p.h. with machine guns cracking and the gun crews busily engaged in feeding ammunition to the Benet Merciers and Colts it makes a business-like spectacle, and is not incapable of being concealed behind stone walls, etc., in the neighboring fields.

Watch Motor Equipment

MILITARY INSTRUCTION CAMP, PLATTSBURG, N. Y., Aug. 29—Keen eyes are focused on the work in progress at this camp. Alert brains are studying the results here accomplished. The prinicples involved amount to far more than the possible 1200 graduates from the school of military instruction, because the men are not the only features of interest to the military authorities of the country.

The war in Europe has brought out the necessity for an adequate supply of material of all kinds. The work of the motor equipment in Europe has opened the eyes of officials in this country as to what the possibilities of its use are



Autocar machine gun express with its crew

when it comes to problems involving quick mobility. In former years the 25-mile-a-day march was considered sufficient for any need under ordinary circumstances. To-day 100 miles a day is not considered too much when it becomes necessary to transport large bodies of men from one point of operation to another. The use of machine guns in Europe has now reached a scale never dreamed of in former wars. It was at one time sufficient to have three machine guns to a regiment of 1000 men; from twenty-five to thirty guns are now considered necessary. The machine guns and the motor vehicles go hand in hand. They are two prominent landmarks in the military history of the past two years.

Both machine guns and motor vehicles are parts of the plan of quick mobility. For this reason, the presence of a machine gun troop fully equipped with motor vehicles at this camp is attracting the attention of army experts to a notable degree. There are fifteen motor vehicles in the camp and fourteen of these are with the machine gun troop.

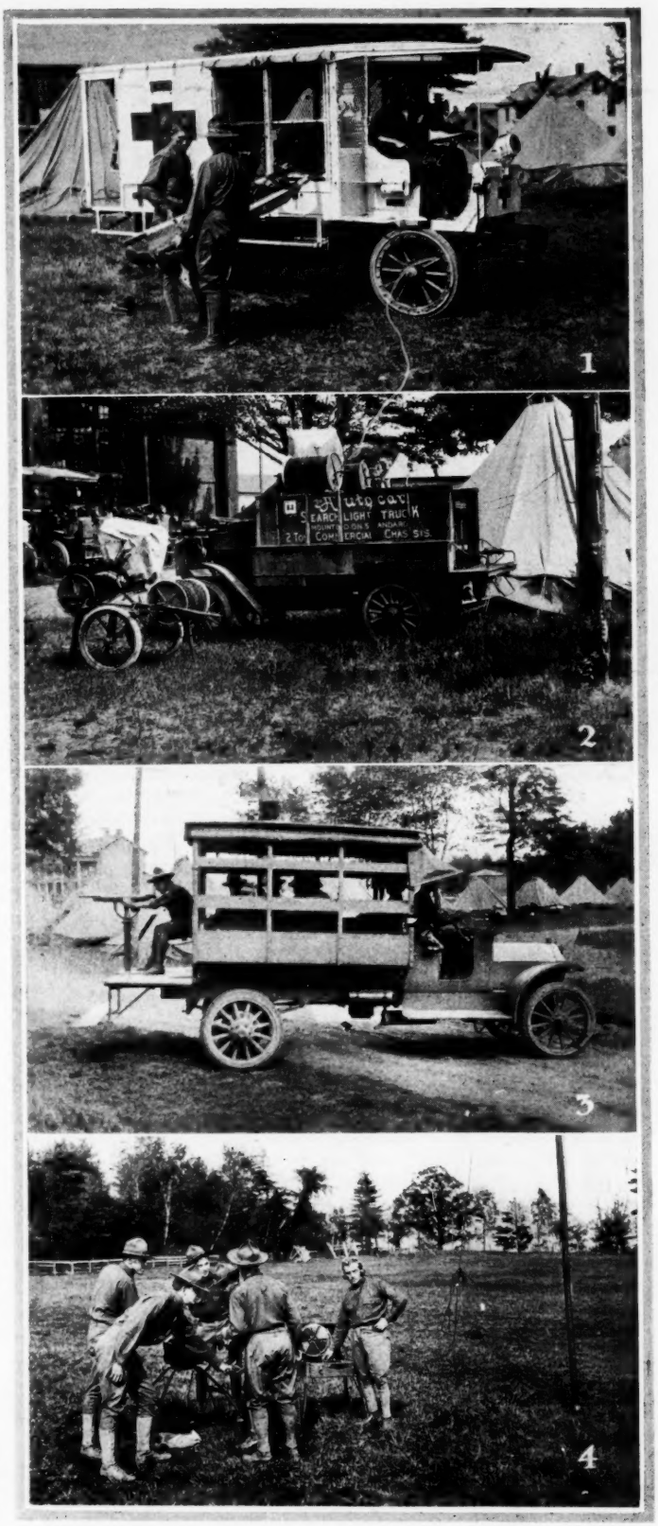
This is the first experiment in motor-transported machine gun units which has ever been conducted by the U. S. Army or the National Guard, because, hitherto, no funds or opportunities for such an experiment have been provided. Private capital has supplied the money for this organization in connection with the military instruction camp and from the experiments here conducted, it is purposed to learn exactly what kinds of cars and trucks are suited for the purpose, how many guns and men can be transported to advantage upon one truck, the speed at which they can be operated, the sort of country they can be used in effectively, and other data which at the present time are merely guess work.

Seventy Men in Machine-Gun Troop

In this troop there are about seventy men, lawyers, bankers, and business men from all over the country. They are graduates from Harvard, Yale, Princeton and other leading universities. With the troop there are twenty machine guns and two 1-pounders. The machine gun expert of the U. S. Army, Captain Wm. Smedberg, is with the troop to instruct the men in the operation of the guns and to keep a watchful eye on the performance of the equipment. Capt. Raynal C. Bolling, general solicitor of the U. S. Steel Corp., who has been instrumental in organizing the troop, is in command. The necessary funds for the experiment have been contributed by Judge Gary, chairman of the board of the U. S. Steel Corp., Geo. W. Perkins, J. P. Morgan, Brown Bros., Potter, Choate & Prentice and White, Weld & Co. In addition, vehicles have been supplied by the Autocar Co., International Motor Co., the Cadillac company, Garford, Simplex, Mitchell, Buick and Hendee Mfg. Co. A privately-owned Ford and a Locomobile are also present. In addition, the Carnegie Steel Co. has supplied armor, the Hay-Buddon Mfg. Co. has provided a field repair shop anvil and the Vought and Williams Co., a forge and vise. The U. S. Tire Co. supplied a number of extra casings for the cars.

With this equipment, there is a sufficient variety for accurate line to be drawn on the possibilities on each type of car. So far, the experiments show that two main factors govern the utility of the vehicle under consideration. They are, the speed and the body. This fact became evident even on the march from New York to Plattsburg, a distance of 400 miles accomplished in four days. Capt. Bolling immediately divided the cars in three classes; slow, medium and high speeds, and laid out the work of each accordingly. Regarding the body, the fact which stands pre-eminent at the present time is that it must be so designed as to be suitable for all around purposes. A special type of body which can only be used occasionally fails to have the general utility necessary in campaign work. This fact will become evident as a detailed study of the equipment at the camp is made.

The Garford truck is of 1½-ton capacity, and on the chassis is mounted an all-around utility body which can

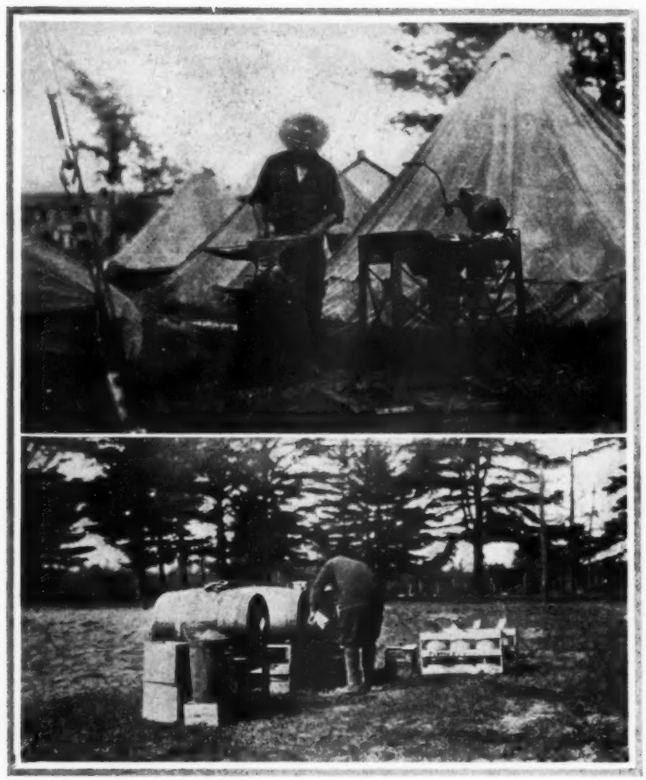


1—Autocar ambulance in action. Wounded man being handled on stretcher carried with car

2—Autocar searchlight truck with detachable searchlight reel, which can be wheeled 1-4 mile from truck, which is the source of power. This apparatus was also employed at Fishkill Landing

3—Garford 1 1-2-ton truck with machine gun mounting. This is an all-around useful body which can be used for transport and machine gun work, or the machine-gun can be dismounted and the body used for ambulance purposes

4—Field wireless crew with apparatus which can be carried on motor vehicles



Field repair equipment carried to the permanent encampments for work on the motor trucks

Field gasoline station used at the Plattsburg camp—here is a feature which could be improved for permanent encampments

Rear view of the body mounted on the 1 1-2-ton Garford truck, which is an example of all-around use

Drawer in the side of the autocar ambulance body containing enough surgical equipment to perform a minor operation

either be used as an ambulance or a transport and machine gun car.

Body as an Ambulance

When used as an ambulance, the machine gun is, of course, removed to bring the car under the protection of the Red Cross. At that time the car can go right to the front and pick up wounded men as far as battle conditions will permit. It has a capacity of six stretchers which can be carried on racks supported within the car on uprights, as will be noted in the illustration on this page. The body, however, is more of a transport and machine-gun outfit than an ambulance. With the machine gun mounted on the rear platform, and with the side seats for the crew, a speed of 35 m.p.h. can be secured. If desired, the seats can be removed and the men crowded together to the utmost capacity of the vehicle. When not near the firing line the machine gun is removed and placed in a bag which is carried in a space provided for it beneath the side seat. The stretchers fold up, the stretcher racks are out of the way and, in a word, all-around utility is the chief asset of this type of body. It can be a field ambulance, a motor transport wagon, an offensive machine gun unit, a rear guard unit, a reconnoitering car, or fulfill any duty of ordinary military usage.

On the Buick chassis, which is of 1500-lb. capacity, there is mounted a type of body which has been found of great use on the battlefields of France when it becomes necessary to transport quickly ten or a dozen men from one part of the scene of operation to another. It is a sort of open express design which can be provided with armor plate if necessary and carries on the rear platform a machine gun mounting for either offensive or defensive work. A car of this class can dash about from one place to another at a speed of from 35 to 40 m.p.h. and with the crew of the machine gun could withstand a considerable attack while the men are performing the work assigned. In other words, a car of this type could be sent on an expedition such as the blowing up of a small bridge, and while the men in the wagon were setting the explosive and arranging the fuse the machine gun could be utilized to hold off the enemy for a sufficient length of time to accomplish the work.

Armored Cadillac in Camp

The Cadillac cars are the military hospital and armored cars which have been described before. They belong to the North Western Military Academy of Highland Park, Ill., and are part of the contingent which recently completed a tour to San Francisco. The armored car can attain a speed of 40 m.p.h. and is equipped with a revolving gun turret. The present car is equipped with pneumatic tires with the spare tire exposed at the side. In time of service these would no doubt be replaced by solid tires. The military field hospital in its present condition has a machine gun mounting on the rear which of course would have to be removed if the car were used for ambulance work. One of the points of this car's equipment are the roller stretchers. These take up so much room that they could not be used to advantage were there wounded men in any quantity.

Submitted for test by the International Motor Co. are two Macks, a 1-ton and a 3½-ton. One of the surprises of the camp has been the performance of the 3½-tonner. This is equipped with demountable armor plated sides and has mounted on its body two machine guns and a 1-lb. rapid fire gun. It acts almost as a land gun boat. On the march to the camp, 400 miles from New York, this truck with its equipment which weighed up to 8 or 9 tons was speeded to 35 m.p.h. In addition to its own load consisting of more than thirty men, the three guns, 15,000 rounds of machine gun ammunition, 12,000 rounds of 1-lb. shells, 800 rounds of 3-in. shrapnel for the field piece, two independent searchlight

systems, one of gas and the other of electric, two independent gasoline systems, and the armor plating, this truck towed a limber and a 3-in. field piece of the latest design capable of firing 9000 yd. or over 3½ miles with accuracy.

The other Mack, of 1-ton capacity, is equipped with pneumatic front and solid rear tires and a platform body upon which are removable sides and tail piece covered with Harveyized steel armor. This is capable of resisting rifle fire at 500 yd. Just for an experiment, the plates were removed and the men opened fire with the machine guns at 200 yd. The hail of bullets failed to penetrate the plate, simply splashing off, but the plates themselves rapidly became crystallized under the vibration set up by being struck blows equivalent to the falling of several ton weights at the rate of over 300 per minute. The result was they soon cracked and fell apart, although at no time did a bullet penetrate through the steel. The steel is guaranteed against rifle fire, however, at 500 yd. with the latest steel bullets. The truck is equipped to carry a Maxim rapid fire gun and a Colt machine gun with full crews for each of these and 15,000 rounds of ammunition. Both the armor plate and guns can be removed on short notice to be set up in a field position. The bodies on both these Macks have been designed by Alfred F. Masury, chief engineer of the International Motor Co., who spent 3 months making a study of European military motor equipment in Europe. A feature is the tubular centrifugal radiator behind the motor in a steel bullet-proof frame.

Simplex Machine Gun Express

On the Simplex 100 hp. is a body which may be called a machine gun express. This body carries a driver for the car and has just sufficient room for a machine gun and crew. It is capable of speeds in excess of 60 m.p.h. and can be used to dash into the enemy's line, operate the machine gun for a short time and then before it can be reached by artillery, make a hasty retreat. It is such vehicles as this that have been of great use on the other side for making quick reconnoissances.

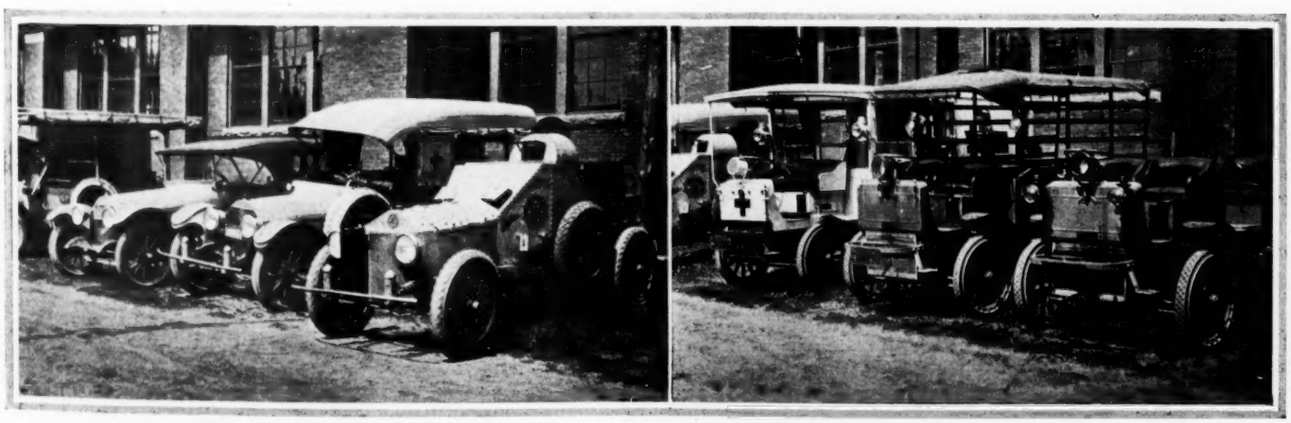
The four Autocars have all special bodies which are similar to those now in actual use on the European battlefields. These are all on the standard Autocar 2-ton chassis. The officers' reconnoissance car can carry a group of officers on a tour of inspection of the lines or for any service at all where it is necessary to take three or four men quickly along the lines. It fills the place of the officers' horses, doing the work much more rapidly wherever it is possible to remain on the road. The searchlight car is the same as that recently concerned in the manoeuvers at Fishkill Landing, N. Y. The searchlight wagon attached to the car can be wheeled a quarter mile away from the truck which contains the generator for the electric current. In this way the searchlight can be taken to the brow of the hill while the power plant remains concealed in the valley below. The motor ambulance is the same as that attached to the Canadian contingent now fighting in Flanders and the military transport is a body intended to convey men to and from headquarters or about different parts of the line. Any of these wagons can be used for transport wagons, the ambulance having carried twenty-eight at Fishkill Plains, besides having had some actual ambulance experience in working over two drowning men who were caught in a stream which was thought to be fordable. This ambulance has traveled up to 40 m.p.h. It has a water tank underneath with a tap on the rear with room for six prone and eight sitting-up besides the crew and on the side of the body there is a drawer containing enough surgical apparatus to perform a minor field operation.

Mitchell Touring Car for Officers

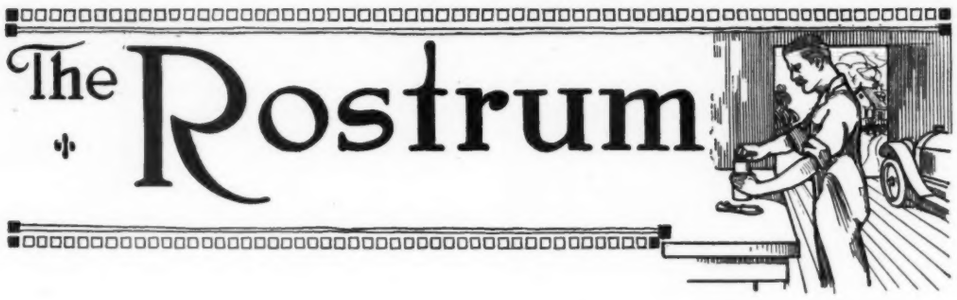
For an officers' utility car there is a Mitchell 6-16, which has a speed of 60 m.p.h. It is a standard seven-passenger touring model. There is also a Locomobile touring chassis and a Ford chassis, each capable of acting as machine gun express cars. The remaining piece of motor apparatus with the machine gun and artillery corps is a Gallaudet tractor bi-plane with a 100-hp. Gnome engine for scout work.

One other piece of motor apparatus is at the camp; this is a wireless truck mounted on a White 1½-ton chassis equipped with a special body to take care of this work. This apparatus can be set up for action in 12 min. and it can send messages 800 miles. The vehicle carries an entire crew and has a generator and complete outfit for sending and receiving wireless messages on the truck. It has a mast for the wireless antennae which are of the umbrella type. The mast is in nine sections and is 85 ft. high. This apparatus belongs to the United States regular army signal corps and has been in use for a little over a year.

Out of the preliminary chaos, however, certain definite facts regarding the uses and requirement of military equipment are beginning to stand forth. The best all-around weight capacity is not above 1½ tons except under special circumstances. Military transport cars must not be merely converted furniture vans or milk wagons, but on the other hand must have special bodies which render them of actual use other than mere vehicles upon which a body of men can pile themselves in traveling across country. With machine gun mounting, many of these vehicles can be made to serve as valuable offensive units. Trucks can be used for towing artillery; with adequate motor-driven apparatus, 100 miles per day is not too much of a journey. The machine gun squad of Plattsburg traveled 100 miles per day for 4 successive days with twenty machine guns, a 3-in. gun and caisson with limbers for each full equipment for the men, cooking outfit, provisions, and all the paraphernalia necessary. Special body design on sturdy, fast chassis will answer the requirements of all-around service far better than miscellaneous trucks picked up here and there.



Views of the motor vehicles kept ready for action at the military instruction camp in Plattsburg



Has Trouble with Gasoline Feed

EDITOR THE AUTOMOBILE:—I have a Winton six-cylinder car. The gasoline tank is on the rear end of the car and the gasoline is forced up to an auxiliary tank on the dash. It then flows down to the carbureter. I also have a four-cylinder Rambler and the gasoline tank is under the front seat and the gasoline flows from there to the carbureter. When running very slowly for 20 min. in hot weather, the gasoline will stop flowing to the carbureter and the car stops. If I wait 5 min. the gasoline will begin to flow again and everything will work properly. Both cars work exactly alike in this respect. Can you give me some advice as to the cause of this?

Riverton, N. J. H. C.

—The fact that two cars act the same renders this a very mysterious state of affairs but there are two explanations which may fit the case. The first explanation is that there are air locks in the piping. It very often happens that in installing the gasoline line, large vertical bends are allowed to occur in the piping. When this happens, there are certain times when the gasoline will be drawn away and what corresponds to a large bubble in the pipe will form in the bend. The result is that the gasoline is choked and cannot flow until this bubble is broken, which occurs due to the weight of the gasoline after a few moments' wait. When the gasoline is again drawn through the piping, another bubble is apt to form and the same occurrence happens again.

The second explanation for your trouble is that, instead of the gasoline ceasing to flow, the condition of running on a rich mixture for 20 min. results in flooded engine which will not again operate until sufficient gasoline has evaporated to bring the mixture down to the range of explosiveness. Above and below this range, a mixture of air and gasoline will not explode. With the ordinary carbureter, the auxiliary air valve will remain closed at very low speeds with the result that practically all of the suction of the motor falls upon the jet and nothing but raw gasoline is drawn into the manifold. After running a short time in this condition, with more gasoline being drawn into the manifold than is being used, the motor is choked and stops. When you wait for 5 min. as you state, the accumulated gasoline evaporates with that result that an explosive mixture is again formed and the car will run properly until the same condition is again set up.

The remedy for the trouble is either to make a lighter adjustment on the air valve, or to install some device admitting extra air to the manifold. A number of these are on the market and can be attached by simply tapping into the intake manifold and by installing a control system, such as a Bowden wire, to the steering column or some convenient position in the car. Whenever the mixture becomes super-rich, so that it is necessary to dilute it with an extra supply of air this can be done from the driver's seat. Such an installation not only guards against the trouble which you mentioned, but also permits a reduction in your gasoline bills by making a leaner mixture for higher speeds at which the car is practically continuously run during a tour through the country.

It would be well for you before making any such installation, however, to go over the piping to see if your trouble is not due to the readily cured air locks due to vertical bends. Referring to the illustration, Fig. 1, the difference between the bent piping which is apt to have air locks and the straight piping in which they are avoided, is shown.

A Metal Lighter Than Aluminum

Editor THE AUTOMOBILE:—I have been very much interested in the articles appearing in THE AUTOMOBILE on the possibility of using aluminum in gasoline engine construction, and am appending a clipping which will speak for itself.

Both the pistons and the cylinders are made of this metal and the writer had the chance to examine the engine lately and found both the piston and cylinders in splendid shape. The length of the cylinders covered by the ring travel, seemed to have even a higher polish than cast iron, and there were no scars on either member and no wear which could be noticed, although it is said that the engine has seen considerable service.

It is possible that Krause has made a discovery which will become very valuable to engine designers.

St. Louis, Mo. C. E. B.

—The clipping inclosed by C. E. B. states in part: "To take a piece of fire clay out of the earth and from it make a metal lighter than aluminum and as tensile as steel, and then take this metal and make of it a 75-hp. motor weighing 175 lb. you are capable of driving a polyplane aircraft 2 m.p.m. is an achievement that bids fair to place its achiever among the great inventors of the world. This is what G. A. Krause claims to have done. It is said that the U. S.

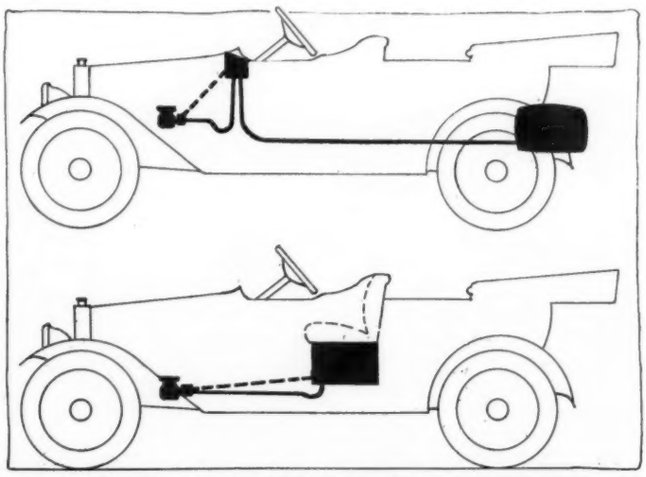


Fig. 1—Diagram showing difference between straight tubing and curved tubing which causes air locks in gasoline line

Government is figuring on a contract calling for 2500 of Krause's motors at $1,600 each or $4,000,000 gross. Naval officers have been in St. Louis a week testing the metal and motor. Speaking of his metal, Krause said, "It is a fire clay product with a specific gravity of from 1.76 to 2.16 and a tensile strength ranging from 21,000 to 35,000 lb. per square inch."

In all probabilities the alloy referred to is a mixture of aluminum and magnesium, although the specific gravity of the well-known aluminum magnesium alloys is generally a little higher than the figure given in the quotation. Magnalium for instance, has a specific gravity of about 2.5. Its tensile strength cast is from 18,000 to 21,300 lb. per square inch, and in annealed plates, runs as high as 42,200 lb. per square inch which is higher than that given above. The reason that the magnesium alloys are lower in specific gravity, is that magnesium itself is very low in specific gravity, this figure varying from 1.69 to 1.75, while the specific gravity of aluminum is 2.6 to 2.7.

With careful working, magnesium-aluminum alloys can be so made that a tensile strength of approximately 53,000 lb. per square inch with a 3.7 per cent reduction in area can be readily secured.

Weakened Magnets Need Recharging

Editor THE AUTOMOBILE:—I have a Velie racer which is equipped with a Mea Magneto from which the machine is started by hand crank and it will not fire at low speed when turned by hand. I suppose the magnets are weak.

This is a foreign magneto and will be glad if you can advise me who handles this apparatus in this country.

Saltville, Va. P. S.

—The reason you give for your magneto failing at low speeds is probably the correct one. This magneto has magnets which are differently shaped, as compared with those manufactured in this country, which as a rule have the standard horseshoe type.

The shape of these magnets is brought out in the illustration, Fig. 2. The magneto is handled by Marburg Bros., 1790 Broadway, New York City.

Grease Will Not Retard Layshaft

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for Aug. 5, page 224, under the heading, Has Difficulty in Changing Gears, would state that I have recently seen in the instruction for another car the request to use heavy cylinder oil in the gearbox. This makes me think that it is quite possible that too stiff a grease might noticeably retard the layshaft. Is not this true?

Boston, Mass. W. G. R.

—It is hardly possible that heavy grease would continuously slow up the shaft although it might do so, for a considerable time after it was introduced into the gearbox. After a short time, however, the rotation of the shaft and gears would cut a path through the grease and the resistance for turning would become so small that there would not be sufficient retardation of the shaft to make gear changing difficult. The slowing of the shaft must be due to something which binds and hence will probably be found in the bearings.

Carrying Capacities and Tire Pressures

Editor THE AUTOMOBILE:—According to statistics recently compiled by THE AUTOMOBILE, the number of automobiles in this country has now passed the 2,000,000 mark. This indicates a tire output of 12,000,000 for this year. An estimate of $16 per tire, which is conservative, will give a valuation of $192,000,000 which will represent this year's output. It has been shown that 30 per cent. of this enormous sum is being wasted by ill-advised loading of tires. In other words, $57,600,000 will be wasted this year through failure to observe proper loading precautions.

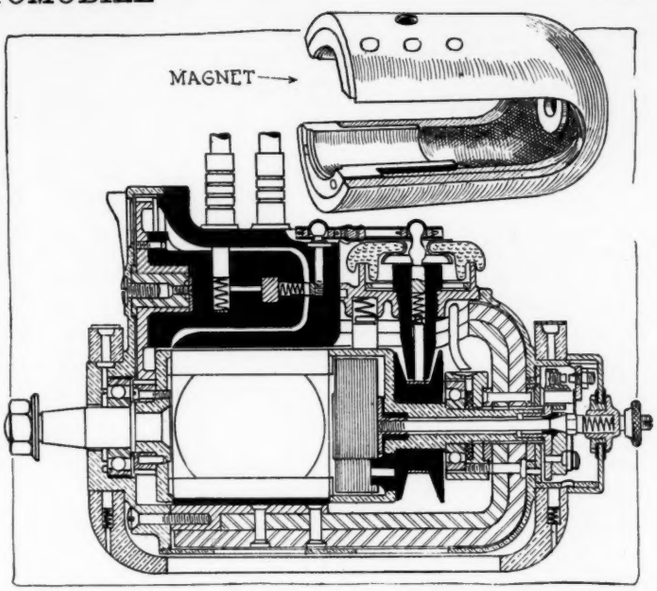


Fig. 2—Section of Mea magneto and sketch of Mea magnet

The load properly assigned to a tire should be the actual load on the tire with the car fully loaded. The actual load on each tire can be ascertained by weighing first the front of the fully loaded car, then the rear, dividing each figure by two to get the load per tire. It can then be inflated to the proper pressure for that particular weight as indicated by the scale of carrying capacities and inflation pressures. A certain tolerance in pressure should be allowed for leakage but before the pressure drops 20 per cent the tire should be pumped up again.

Realizing, of course, that every consumer has a right to his own ideas as to what constitutes good service, and that no practical inflation schedule will cover all possible conditions of service, the following schedule is offered and recommended by the Goodyear Tire & Rubber Co., as a guide under normal conditions:

Gross Carrying Capacity, Pounds Per Tire, Including Passengers and Complete Equipment

	Tire Section Diameter						
Inf. Press.	3-in.	3½-in.	4-in.	4½-in.	5-in.	5½-in.	6-in.
30	250						
35	290	360					
40	335	410	500				
45	375	460	560	675			
50	415	515	625	750	875	1000	1140
55	460	565	690	825	960	1100	1255
60	500	615	750	900	1050	1200	1370
65		670	815	975	1135	1300	1480
70		720	875	1050	1225	1400	1595
75			940	1125	1310	1500	1710
80			1000	1200	1400	1600	1925
85				1275	1485	1700	1940
90				1350	1570	1800	2050
95					1660	1900	2165
100						2000	2280

Akron, Ohio. H. S. QUINE.

Why Speed Increases Fuel Consumption

Editor THE AUTOMOBILE:—Would there be any difference in the amount of gasoline consumed in a car going 40 miles, at the rate of 40 m.p.h. and the same car on the same trip going 10 m.p.h.?

New Westminster, B. C. L. W.

—There would be a difference in the gasoline consumed going at these two different rates of speed and the probabilities are that there would be less consumed for traveling the distance at 10 m.p.h. than there would at 40 m.p.h. The reason for this is in the wind resistance. In traveling at 10 m.p.h. the wind resistance for each square foot of projected area against a vertical transverse plane would be .492 lb. At 40 m.p.h. this resistance has increased to 7.873 lb. There-

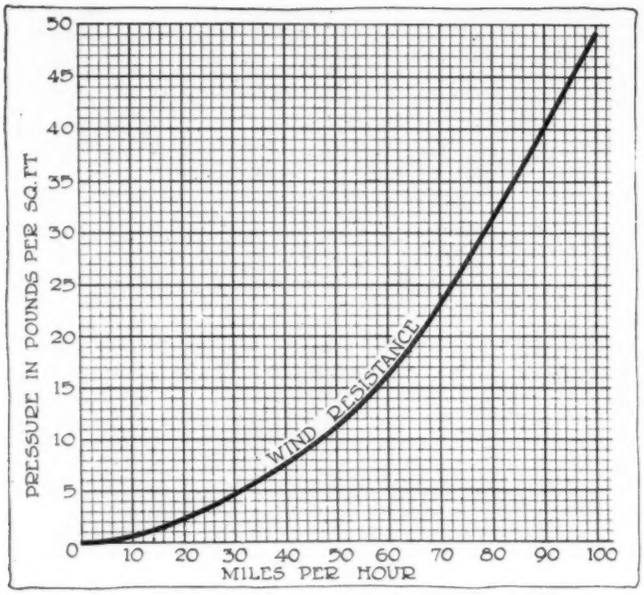


Fig. 3—Curve of wind resistance at different speeds

fore, if the projected area is 25 sq. ft. this pressure amounts to a considerable quantity at a rate of 40 m.p.h. The power required to overcome wind resistance can be figured approximately by a formula which is given as follows:

$$H.\ P. = .96\ P\ A\ M$$

In this formula *H. P.* is the horsepower required to overcome the wind resistance, *P* the pressure of the wind in pounds per square foot and *M* is the speed of the car in m.p.h., thus, assuming a car with a front area of 10 sq. ft. and a speed of 60 m.p.h. the power required to overcome the wind resistance alone, will be 20.8. A curve of wind resistances for different speeds is given in Fig. 3.

Wants Conventional Piston Defined

Editor THE AUTOMOBILE:—Do you know of any books, in either English, French or German which take up the design of motor vehicles from an engineering standpoint? If so, give price and tell whether you can furnish them.

2—How can I secure a copy of the S. A. E. handbook?

3—How can one secure junior or student membership in the S. A. E.?

4—Can you furnish indexes to articles published in past issues of THE AUTOMOBILE and if so, do you furnish back numbers of the magazine?

5—Do you know of any list of allowable unit working stresses used for the different materials entering into the make-up of an automobile?

6—What is the conventional piston design? Is there a similar design for the other parts of an engine and if so, where can I find them?

Chillicothe, Ohio. N. S. A.

—There are a large number of books covering this subject published in all three languages and it would be impossible in the space available here to give a full list of these together with their authors and publishers. It is suggested that you communicate directly with different publishing houses for their list of books covering the subject you outline, in the different languages.

2—Copies of the Society of Automobile Engineers' handbook can be purchased from the offices of the Society at 29 West Thirty-ninth Street, New York City. The book is sold in loose-leaf form with leather binder. It is in two volumes.

3—A junior or student membership in the Society of Automobile Engineers can be secured by filling out the form of application blank provided by the Society whose address is given above. It is only necessary to address the secretary of the Society who will be glad to furnish you with application blank on the back of which are printed the requirements for membership in any grade. The Council of the Society, when acting upon the application blanks, determines the grade of membership to which an applicant is most suited.

4—Indexes to the back issues of THE AUTOMOBILE are published semi-annually in the last issue in December and in June. Back numbers of the periodical are furnished whenever they are had in stock.

5—So far as THE AUTOMOBILE has any record, there is no published list of allowable unit working stresses used for the different materials entering into the make-up of an automobile.

6—There is no definite conventional piston design as a piston might be made in several different ways as regards the number, position and kind of rings and yet still be conventional. The only parts of an automobile which may be said to be strictly conventional in every way are those which follow the standards laid down by the Standards Committee of the S. A. E. Such things as I-beam connecting-rods, I-beam front axles, channel frame members, horizontally split crankcases and a large number of other details found in every car are what might be called conventional although no two are exactly alike.

Tire Size Affects Speedometer Reading

Editor THE AUTOMOBILE:—The speedometer on my car is made for a 36 by 4½ tire, and by using a 37 by 5 tire, what is the difference in per cent on the mileage?

If the speedometer registers 20 m.p.h. how fast is the car really going and how is it figured up?

Montreal, Ont. W. O. G.

—The fact that you have changed your tire size to 37 in. diameter and kept the 36-in. gear for your speedometer drive will make the speedometer register a lower speed than you are really going. The reading on the speedometer for a definite sized gear will vary inversely as the diameter of the tire. Therefore, the speed shown on the speedometer will only be 36/37 of your actual rate of travel or, in other words, only 97.3 per cent of your actual speed. To secure the proper speed reading, you will have to take the speed shown on your meter and multiply it by 1.027. The accompanying illustration, Fig. 64 shows the problem diagrammatically since the speedometer really measures to the speed of which the wheel is revolving. It will take a larger wheel a less number of revolutions to go the same distance than a small wheel, because the circumference of the larger diameter wheel is greater.

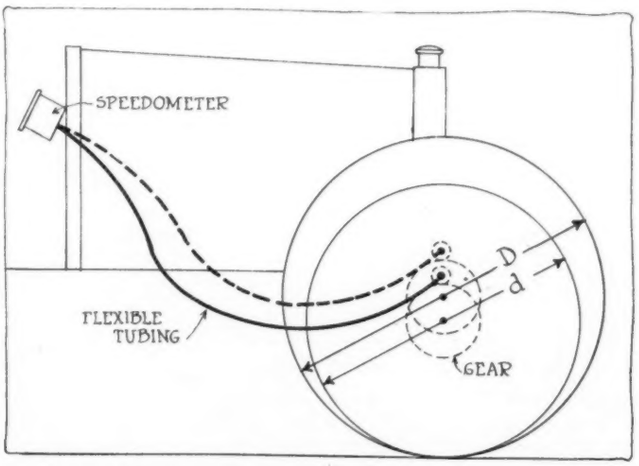


Fig. 4—Diagram showing how tire size affects speedometer reduction

The Car That Stays Young

By M. C. K.

When prices are forced down by competition and values drop more than the prices the first cause is always the public's inability to distinguish between genuine and imitation values. Nobody really prefers what is shoddy or prefers to make it. This being the case, what could be more logical than to cultivate insight in values? The following article, in connection with the responses it may call forth and continued work with details, is an experiment in this direction. It may fall short of its aim, but the classification it introduces cannot help proving useful in some degree.

COMPLETE competence to form and explain a first-hand conception of The Car That Stays Young is divided among hundreds of persons and therefore does not practically exist. Little bits of special technical knowledge relating to paints and rust, leather and imitations of leather, upholstery materials and trimmings, seat springs and brass tacks, colors and dyes, surface qualities and ductility of skelp, rigidity and elasticity of rods and wires etc., must be combined with a large and discriminating driving experience as well as with engineering insight and good sense for the fitness of things, in order to round off a detailed mental image of The Car That Stays Young with a minimum of maintenance and in which nevertheless a smart and creditable appearance is not sacrificed from the start to offset in advance the inroads of wear and tear.

All have piecemeal ideas on this subject, as the ambition to produce or own The Car That Stays Young is universal. Only a few nowadays measure their satisfaction by the amount of painstaking care needed to keep their vehicle trim and resplendent; this particular form of vanity from the horse-and-carriage days having almost disappeared even where most of the labor involved falls to the lot of a hired chauffeur. But the universal desire for a car that will continue to look fit, robust and up-to-date when past middle age usually finds a negative expression. The "cheap" car which nobody wants but which multitudes buy unknowingly is the opposite and the negative of The Car That Stays Young; it may be high-priced or medium-priced or low-priced, but if it gets the reputation of being "cheap"—with some other popular adjectives in reserve for emphasis, if needed—it is mainly because it turns out that it always ages prematurely, in efficiency, in looks, in sounds, in style. Rarely does the word refer only to an inharmonious crudity in lines and proportions; for of this shortcoming many an owner can remain happily unconscious, while to others, though they did not notice it at first, it gradually becomes a more and more aggravating source of mortification; it "gets on their nerves" and prompts them to get rid of the car.

Hundreds of errors can be committed in the design and production of an automobile, and it takes only three or four serious ones to place upon it the stigma of cheapness. There is no end to the combinations of mistakes which will result in this lapse from grace, and no single conception of the "cheap" car can therefore be set up. The word, implying only a denunciation and negation, suggests no useful arrangement of the ideas which it conceals. Yet the general avoidance of all the faults for which this commonly employed word may stand would mean a remarkable sort of progress of great economical and esthetic or educational value —with the usual commercial rewards for those accomplishing it in marked degree or in the most judicious manner. At this point the conception of The Car That Stays Young, being positive and comprehensive, suggests itself as one that can be cultivated and built up till it stands almost as clearly before the constructive mind as the actual Panhard-Levassor car did in 1895 or the Mercedes in 1901. The Car That Stays Young also represents a group of facts and ideas which can be followed up independently of routine work at factories and independently of other descriptive or test-recording work in the press. The conception is in itself a classification of important facts relating to the future value and usefulness of a car; facts which are usually snubbed in comparison with the careful attention given to all factors of the present day and hour, which always automatically assert their importance. Such a classification developed into a living and growing thing, to whose completeness automobile owners, repairmen and members of allied industries may contribute greatly from their experience, might eventually become a standard and highly specialized work of reference on Durability, which is the property on which data are most difficult to secure.

In view of so many chances for contributing a mite to progress by starting inquiries and the collection of data under a new and promising caption, the writer will try to give an outline of the leading ideas and questions which arise when one attempts to draw a mental picture of The Car That Stays Young. Having no special competence to answer the majority of the questions, he must leave them open, supplying only a framework to be covered and dressed gradually with the assistance of those who possess exact knowledge on the point involved in each instance.

Some very general considerations on design and style present themselves first.

Fancies Seldom Durable

The Car That Stays Young is meant to be used for a number of years. It can have no conspicuous design feature which is liable to be generally abandoned in later cars. A powerful conservative factor hides in this self-evident rule. It acted strongly against the introduction of 6-cylinder cars with long motor hoods, as the guarantee of the permanence of the type was vague; much less strongly against the V-eight and the twin-six which are shorter, and most of all in favor of the simple four which is standard. It forbids excessive rake of steering post and very low seats, huge fenders, bath-tub and boat bodies, fancy curves and garish colors. Any new style feature for which no substantial utilitarian reason can be advanced comes under the ban, but also the most promising engineering innovations are excluded so long as they remain subjects for discussion. Very knotty questions, can of course, come up in choosing between motors of thoroughly established durability on one side and 40-speed (2,400 r.p.m.) or 50-speed (3,000 r.p.m.) motors of more advanced design or Knight motors, on the other side; in choosing between silent or roller chain gears and spur or miter gears, between ignition by magneto or by some of the devices which have followed the wide adoption of electric lighting and starting. Among starter systems the choice is as yet difficult. Even a highly sagacious judgment coupled with the greatest care in examining the product, to see whether innovation has been undertaken lightly or with thorough revision of all the construction features which it may affect, can scarcely give the full assurance that comes with Time and Reputation—speaking of time and reputation relating specifically to the design feature under debate in each case and not merely to the manufacturer's methods and standing in general; all make mistakes at one time or another.

The ambition to assist in testing out new principles in motor engineering by investing in the "last cry" and the desire for acquiring The Car That Stays Young are not fully or safely compatible. But on the other hand one who buys The Car That Stays Young has a long time to wait until he can do so again. Progress has time to mature fully before he needs to go into the market once more. Science becomes safely industrialized while he is slowly wearing out his first purchase. To display a fine dash in selecting a car in which the most advanced ideas are embodied must always be a luxury and a risk, since scarcely any important idea reaches practical maturity till it has been on trial for 3 years with the manufacturer and for 3 years more with the public. "Art is long and life is short" holds good for the art of building cars and for the lives of the users. If the object is to crowd sensations and technical automobile experience into the short span of years during which motoring for the sake of motoring remains interesting to any one individual, the Car That Stays Young is not in all respects the ideal, but among the general public probably not more than one in a hundred will deliberately buy experience if he knows how to buy satisfaction. If style and lasting utility with few troubles can be combined, he will prefer such a combination to a flash of pride in a car that is marvelous today and doubtful next year.

Large Progress Matures Slowly

The number of years required for the thorough *mise au point* of important engineering ideas can be realized from examples. The ups and downs of alloy steels have not come to rest yet. Riveting is not yet a perfected process for frames, but frequently gives way in trucks where loads are heavy and vibration is pronounced, yet no form of welding takes its place entirely. Patience forsook nearly all who tried to subdue the promising air-cooled motors, but it survives in a single important instance among automobiles as well as for one class of aeroplane motors and now bids fair to come to new life in twin fours, sixes and nines. The gradual increase of stroke length and piston speed, with the accompanying lightening of parts, is still seeking its best limits in European cars and corresponding but different limitations suitable for American conditions and fuel prices. No spring system departing from the standard has yet been accepted as finally superior. The two-cycle motor is still stubbornly advocated and represented in Europe, though little used. The motor bus is still in its infancy in the matter of general design and weight. Every step toward the best has its pitfalls and stumbling blocks and is contested by the fairly good whose shortcomings are known but endurable.

Where the influence of these more fundamental features in motor vehicle construction are concerned the question of cost of production is in the background for determining whether the vehicle will be one that Stays Young or otherwise, while technical ability, experience, system and capital of the concern undertaking an innovation of this order must be accepted as factors greatly reducing the risk for the purchaser. For example, if a firm known to have all facilities for conducting tests and a large reputation at stake announces that electric castings have replaced drop forgings in its new car, it is fair to assume that it has found a reliable technical advantage in the change—say one depending on a stronger alloy and simpler heat treatment—but if a firm with fewer safeguards against error were to switch from forgings to stampings the change could not be accepted with the same assurance, and were it to adopt castings there would be room for a suspicion that they were chosen for being cheaper in small quantities. Though the industrial history teems with examples of technical slips committed by large firms and resulting in reducing the durability and reliability of its cars for a season or two, it abounds in far greater degree in examples of minor concerns which have gone to the wall for daring to take a technical lead prematurely.

If The Car That Stays Young is to have advanced technical features at all comprehensive or vital in character, it is therefore necessary to conclude—as most purchasers indeed do conclude—that it should at least be the production of a concern having much to lose by an error. There is scarcely any room for patronage of the admirable strugglers in the industry unless they stick closely to the established data in all important engineering features and surpass their big competitors in attention to the taste and durability of details and appearances.

Where Judgment Presides

With regard to these details and appearances the requirements for The Car That Stays Young fluctuate of course somewhat in conformity with the progress that is accomplished from year to year or from day to day, but the sins which are committed to meet the price question or for lack of knowledge of the "unmechanical" materials are usually definite and avoidable; somebody knows how the most favorable proportion between cost and value could have been maintained, while in the case of one of the larger technical questions nobody knows the final equation for sure or has means for proving his knowledge. The simplest observations in the streets, roads and repair shop disclose a number of details which make a car old in looks or action or both, and many which suggest inquiries.

Vulnerable Fenders

Crumpled, buckled and rusty mud fenders are common and very disfiguring. The means for obviating this trouble are found not only in careful driving, but in the use of crowned shapes which are much stronger than the flat ones against all impacts and resume their shape after a slight buckling, and in avoiding to have the edges of the fenders extending so far in any direction that they will be sure to receive accidental bruises in the traffic or the careless entering of a garage. The manufacturer is not always supposed to have anything to do with the careful driving which protects fenders, but it is readily realized that in reality the responsiveness of clutch, carbureter, steering gear and brakes and even the change-gear ratio, the shapes and locations of levers, pedals and throttle-control have great influence to facilitate just those minor swerves in emergencies by which the caroming with other vehicles is avoided. From this point of view the protection of the fenders becomes a deeply technical problem. The use of crowned shapes is simpler and, while the best of these, which have no flat portions, cost more than flat ones, they can be narrower than the latter with the same clearance for spring action and the same protecting capacity, since they envelop the wheel more closely. They are therefor naturally less exposed as well as stronger and prettier. No doubt, there are some advantages to be gained for the ordinary flat fender by studying the material, the shapes and the points of attachment of the brackets which support it. Elastic yielding may be encouraged, perhaps. Data may be in existence on these particulars, but an obviously safe precaution lies in having some more robust part project farther than the edge of the fender. The value of a prominent hub cap and of a running-board a little broader than the fenders with which it connects, is probably well worth looking into. An outward flare is an old expedient, which may afford some protection by allowing the fender to yield elastically to an impact which would injure it if received squarely edgewise. A close study of the smallest possible dimensions of the fenders consistent with their purpose leads to the crowned type eventually, but would reduce many flat fenders to safer proportions where price is important. The flat but edged fender is the compromise solution. The front fender which turns with the wheel may be susceptible of improvement, but here barely requires mention, as it represents no established practice. With regard to a finish

for fenders other than paint or baked enamel and materials other than sheet iron and aluminum, every practical possibility is as yet to be classed among innovations and therefore not yet of interest for building up a conception of The Car That Stays Young.

Other points, each of which also branches into a network of questions, are such as the following:

Radiators, to keep them from leaking or having cooling fins crumpled.

Rusty mufflers and exhaust pipes.

Dented motor hoods; rusty streaks at joints with radiator and dash.

Running-boards; with or without an apron.

Foot-board finish; pedals and pedal slots.

Motor finish and noises; mounting of motor and drip pan.

Wire and wood wheels; demountable wheels; demountable rims.

Steering linkage; joints, buffer springs, noises, finish.

Front seats and their upholstering.

Doors and hinges.

Paint and varnish, composition and colors.

Leather and its substitutes; cloths; seat springs.

Lines of wear on bodies; exposed portions in general.

After commenting upon each of these points in the next instalment, an effort will be made to sound specialists in the automobile industry or its allied industries for definite data on the features with which they are most familiar.

(*To Be Continued*)

Eisemann Device Starts Heavy Motor When Cranked Slowly by Hand

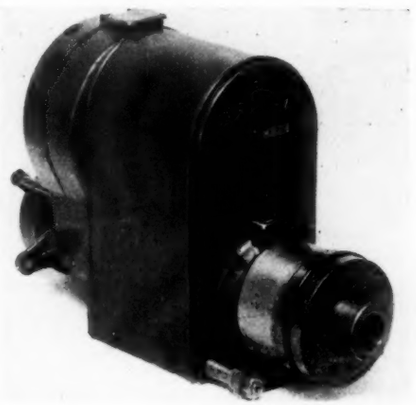
WHAT is termed an impulse starter has been developed by the Eisemann Magneto Co., Brooklyn, N. Y.; it is a device which causes a standard magneto to produce a hot spark, regardless of how slowly the motor is cranked. It is intended especially for heavy motors used on trucks, tractors, etc., though it may be employed on passenger cars as well.

The production of a hot spark regardless of cranking speed is produced by automatically compressing and releasing two springs which are part of the driving mechanism and which give the armature a sharp twist and thus cause the spark to occur at the proper moment. At speeds above 120 r.p.m. the device is automatically drawn out of action. The device can be attached to any model Eisemann magneto.

Fig. 1 shows the device when the motor is running, when it merely acts as a coupling between the drive shaft and the armature.. Fig. 2 shows it just before the trigger lets go and the armature is snapped forward, producing the spark.

The member *A* is driven from the timing gear; *B* is the part that drives the armature; *C* is a trigger which transmits the drive from *A* to *B* when the motor is running, and drops in the notch in the cross bar by the action of gravity when the crank is slowly turned.

The impulse springs are placed between the two blocks *D* which are fastened to the driven member *B* and the



Eisemann impulse starter and coupling mounted on magneto

pins *E* which are part of the driving member *A*. Turning *A* in the direction of the arrow compresses the springs.

When the crank is turned the trigger is moved around so that it drops into the notch in the cross bar by gravity, and thus holds the driven member *B* temporarily against rotation. Further movement of the crank handle compresses the springs, and when the compression is complete the cam on the trigger comes into contact with the driving member *A* and pulls the trigger away from the notch in the cross bar thus releasing the driven member and allowing it to fly in a clockwise direction; rotating the armature and producing the spark.

The trigger is heavily weighted on its upper half, and as soon as it is rotated it tends to move inward still further so that when the driven member snaps in a clockwise direction the trigger drops into the notch *F* in the driving member, Fig. 1. This feature allows the drive to be positively transmitted and removes the load from the springs. This connection is maintained until the speed drops below the minimum operating speed of the motor, at which time gravity becomes stronger than centrifugal force and allows the trigger point to come into contact with the notch again.

All parts are fully inclosed and operate in grease. The device also incorporates, on its driving side, a standard Eisemann coupling which not only gives flexibility, but also allows the magneto to be removed by lifting directly upward.

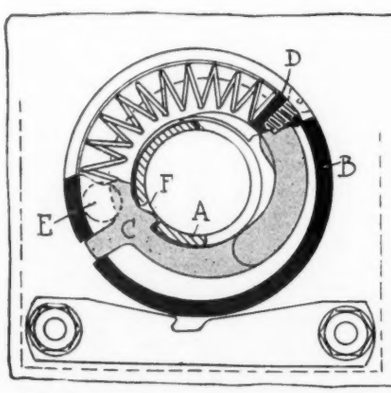


Fig. 1—Impulse starter in position for motor running

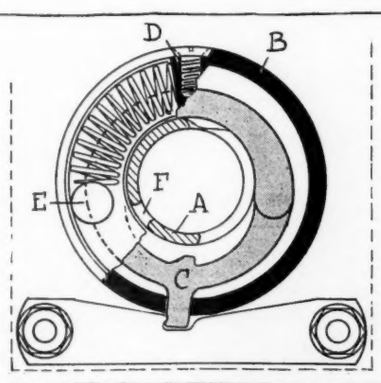


Fig. 2—Impulse starter just before armature is released

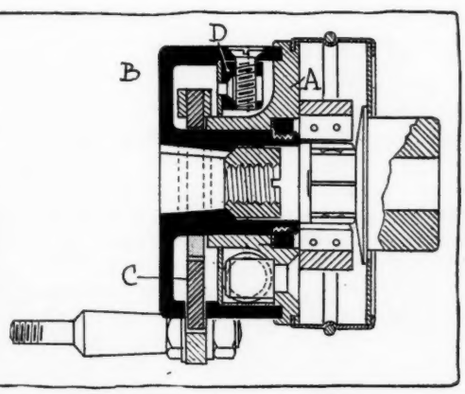


Fig. 3—Section through starter and coupling. Trigger is shown at C

ACCESSORIES

Pagel Oil Indicator

AN oil feed indicator which will stop the motor instantly should the lubricating oil become exhausted in the crankcase, the strainer clogged or the pipes leaky, has been brought out under the name of the Pagel oil feed indicator. This indicator also checks excessive speeds of the motor. It is mounted on the cowl board in the customary manner. The oil register fits in a 2-in. hole and has a ⅛-in. standard pipe thread connection either internal or external. The automatic motor stop is made either for the pressure or non-pressure feed system and is so arranged that by attaching the ground wire from the magneto it will stop the motor automatically should the oiling system fail. It is a plunger device, as shown in the accompanying illustration, being so arranged that when the oil ceases passing through the feed, the plunger is seated and grounds the magneto.

The oil enters the opening of the oil feed indicator at the left and on its way forces its piston backward. This piston operates in a tapered cylinder. The oil flows past the piston and out again through the opening at the right. The movement of the piston causes the hand control to rotate, the dial being insulated, and when the oil ceases to pass through, the indicator rests on the motor stop pin, thereby short-circuiting the magneto and stopping the car. The speed pin can be set at any desired rate and when the motor speed is sufficient to carry the indicator to the pin, it short-circuits. This does not stop the motor but prevents it from going faster. The oil feed indicator sells for $2.25 f.o.b. Sycamore, Ill. The Pagel oil register may be obtained for $1, as may be the Pagel automatic motor stop.—Turner Brass Works, Sycamore, Ill.

Goodrich Gasoline Hose

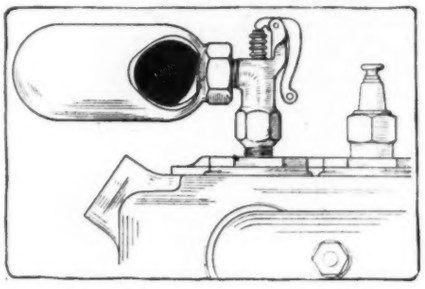
The inside rubber tube of the Goodrich gasoline hose is protected from the action of the gasoline by a fine fabric especially treated which is held in place by a steel wire. Thus, no matter how much disintegration takes place no particles of rubber, no matter how small can possibly get into the gasoline and thus cause trouble in the carbureter or motor. The wire is a flat steel spiral covering approximately two-fifths of the fabric surface and it prevents the hose from kinking. The hose is made in two styles, the Commander and the Goodrich. The latter has a smooth surface and the protecting wire in its interior is wider than that of the Commander variety which has a corrugated surface.—B. F. Goodrich Co., Akron, Ohio.

Buell Explosion Whistle

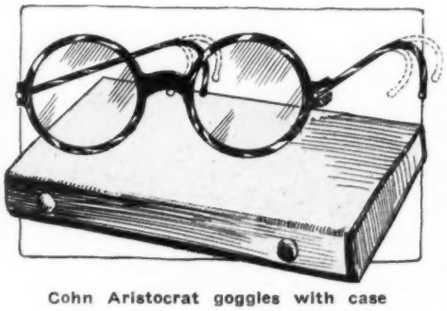
A novel idea in warning signals has been brought out under the name of the Buell explosion whistle. It comprises a whistle type of signaling device mounted in the valve cap of one cylinder where a portion of exploded gas which attains a pressure of from 250 to 300 lb. is used to blow it. The mounting usually employed with the whistle is shown in the accompanying diagram, the device screwing into a special plug by means of a standard spark plug thread.

The device is quite simple, consisting of a small poppet valve and a high pressure whistle controlled by a 1/16-in. cable located on the steering column. The valve is very sensitive so that a slight touch is all that is necessary to blow the whistle, and one of the great advantages of the signal is that the gas is clean, therefore not choking up the whistle with carbon and soot after it has been in use for a short time. The whistles come in two models, a single tone and a chime, both being 2 in. in diameter, and are of compact design. The chime is produced by three different tones, one of which is quite low and designed to give a pleasing tone to the whistle. With this arrangement, an easy musical signal is given when time is not pressing, but in case of emergency, an abrupt and powerful warning can be produced.

The special plug is useful on Ford cars and other cars where it is not possible to mount the whistle in a valve cap. The price of the three-tone chimes supplied in any spark plug thread size is $6, and a single-tone whistle with valve, $4.25. The special spark plugs for Ford cars, etc., are $1.25.—U. L. Mfg. Co., Chicago, Ill.



Buell explosion whistle mounted on cylinder



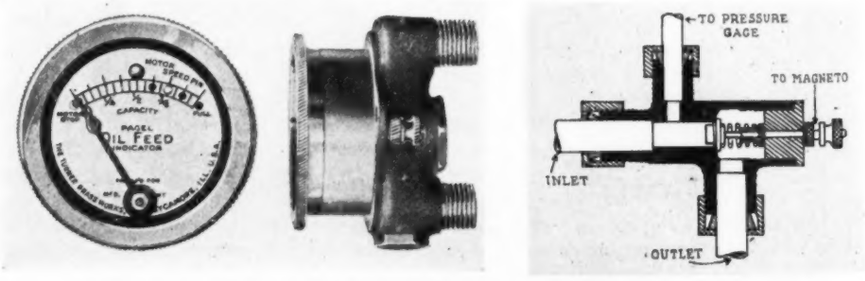
Cohn Aristocrat goggles with case

J-M Narco Tire-Cut Filler

This tire-cut filler is designed for sealing up little cuts and scratches in the casings of tires which would otherwise be enlarged by sand and stone particles and it is claimed to greatly prolong the life of casings treated in this manner. The filler welds itself to the walls of the cut and the loosened tread and solidifies quickly, becoming an integral part of the tire without in any way impairing its resiliency. The filler comes in small tubes at 50 cents and in larger ones at $1.00. Tapering spouts on the tubes permit of quick and easy application.—H. W. Johns-Mansville Co., New York City.

Cohn Motor Goggles

A complete line of goggles for automobile use is incorporated in the five brands known as the Turtle, Peerless, Tourist, Aristocrat and Elite. The Turtle is the goggle with round eyepieces and patent frames and temples. The feature of the glass is the fact that the temples can be bent to any desired size or shape, as they are unbreakable. Folding side sheets of the same material, known as Zylonite, are supplied if desired. Peerless is a



Front view, side view and pipe connection detail of Pagel oil feed indicator

slightly different shape goggle and also has the Zylonite frames and unbreakable adjustable temples. Side guards can also be furnished with these. The Tourist is a flat, straight frame goggle with horizontal bridge so designed that it can be worn over the regular eyeglass. Like all the other goggles in the line, it has the unbreakable adjustable temple. The Aristocrat is a curved bridge goggle with a round eye, 2¼ in. in diameter. The Elite goggle is designed to fold and has collapsible temples which are also composed of the non-breakable Zylonite. These are wide, rectangular lenses with a hinged frame, the eyepieces being 3 in. long by 1⅞ in. high. Prices vary with the designs and the lens sizes.—Max G. Cohn & Co., Inc., New York City.

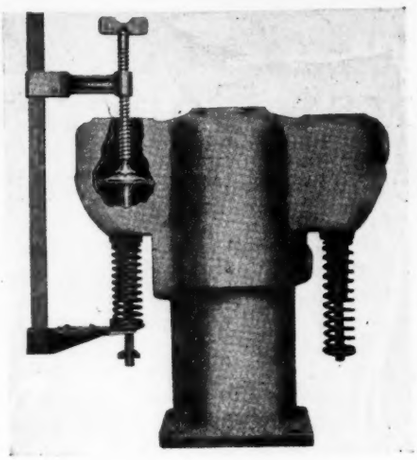
Mertz Valve Spring Release

A valve spring release for the purpose of taking out the spring seat retainer and otherwise working with a valve against the valve spring, has been brought out under the name of the Mertz valve spring release. It consists of a vertical bar at the lower end of which there is a projection fitting beneath the valve spring seat and at the upper end has a clamp which can be screwed down directly on the valve itself. In order to have the correct height for the arm containing the clamp which screws down upon the valve, there is a sliding arm which locks in any position on the vertical bar.

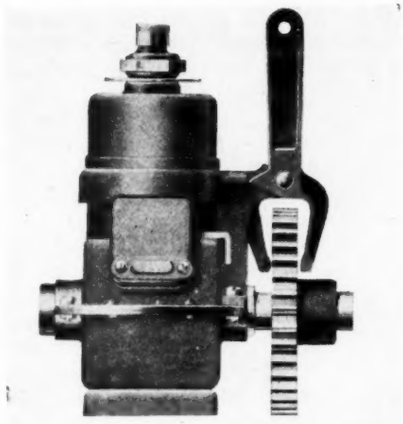
The correct length of the instrument is given on removing the first valve. At the bottom there is also an adjustable gage to fit the valve spring washer and the correct height of the instrument is fixed by locking the clamp holder in the correct position. The operation of the instrument can be readily grasped from the accompanying illustration. The pitch of the screw thread on the clamp is such that the strongest valve spring in use can be compressed by merely tightening on the thumb screw with the thumb and forefinger. The price of the release is $2.—H. B. Mertz Co., Pittsburgh. Pa.

Advance-Toledo Power Tire Pump

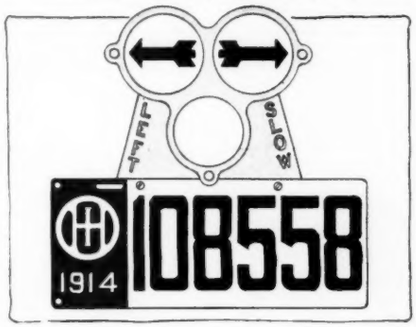
This is a pressed steel tire pump which can be fitted to used cars as well as to new. The cylinder and upper half of crankcase is a steel stamping, and the cylinder itself is reamed and burnished. The lower half of the crankcase is also a steel stamping, giving a two-piece body, both steel stampings, and giving the advantages of strength and lightness expected from this construction. The piston is of cast iron with soft steel rings. The pump crankshaft is a drop forging, and the bearings are nickel-babbitt die cast in the body. The pump is provided with a gear shift so designed that the sliding gear on the pump crankshaft is assembled with the hub on the outside.



Mertz valve spring release



Advance-Toledo power tire pump



Safetylite rear signal and license plate combined showing direction arrows

Warren motor restaurant for five

The advantage is that when the gears are put into engagement with the drive the stresses are all close to the pump bearings.

The intake port is covered with a protector which prevents dirt or sand from entering the pump, and the hose connection at the pump end is a special design, giving a large opening into the hose and a large substantial thread at the hose end. The pump sells for $15 with all fittings.—Advance Machinery Co., Toledo, Ohio.

Premo Accessories for Ford

Under the name of Premo two new accessories have recently been put on the market, one a constant tension fan belt adjustment for Ford cars and the other a gas and spark control for Fords. The constant tension fan belt adjustment consists of a coil spring attachment which clips to the fan belt pulley shaft holder and holds the belt perpetually under the proper degree of tension.

The gas and spark control is supposed to take the place of that originally on the car by slipping the polished brass collars over the teeth of the old quadrant and clamping the friction device to the levers. The makers claim a gain in appearance and durability. The price of the fan belt adjustment is 50 cents and of the spark and throttle control $1.—New York Motor Device Co., New York City.

Safetylite Rear Signal

The Safetylite is the name of a rear signal recently put on the market which indicates the direction in which a car is going to turn as shown in the accompanying illustration by means of arrows. The device consists of an aluminum casing containing electric bulbs controlled from the dash or steering wheel. The light from the bulbs brightens either the right or the left arrow so as to render it clearly visible to a driver in the rear. The signal is fitted with a standard license-plate bracket and sells for $15.—Automatic Signal Appliance Co., Cleveland, Ohio.

Warren Motor Restaurants

The Warren line of motor restaurants is comprehensive, embracing every style and size, but the one which appears most popular is naturally the five-person type illustrated herewith. It is made in style like a suit case, a wood box being covered with black enameled duck and lined with black and white striped enameled cloth. The case contains two nickel-plated food cases, each 8¾ by 5¾ by 4¼ in., knives, forks, spoons, cups and plates for five persons, two glass jars and a place for a vacuum quart bottle—which is not included. The case is 19½ in. long, 14 in. wide and 6 in. deep. The set sells for $17.—Warren Leather Goods Co., Worcester, Mass.

America's First Concrete Speedway

Twin City Oval Ready for 500-Mile Derby

THE Twin City concrete speedway on which the first annual World's 500-mile Derby is to be run on Saturday, Sept. 4, is America's only concrete speedway, and is regarded by F. H. Wheeler, of Indianapolis, Ind., its chief promoter, as the greatest in the world. It is a 2-mile track, laid inside a high wooden fence over 3 miles long. It is just south of the Minneapolis city limits and is only a short distance across the Mississippi and Minnesota rivers from St. Paul. It is decidedly a Twin City affair. To date the investment has been $870,000, which will be raised to near $1,000,000 when the grounds are landscaped next Spring.

The track is 80 ft. wide for 1577 ft. in front of the judge's stand, and on the turns and backstretch is 60 ft. The straightaway is 285 ft. long, practically flat, with an angle of only 1 ft.

From the ends of the two stretches are easement curves of 800 ft. entering into the high circle or leaving it, at 8 ft. height. These four easements allow the drivers to rise gradually into the total angle of 14.98 ft., or extreme height at the outside from the ground at each end of the oval, and to drop down again into the stretches. The change from the end of the easements into the high curve is a 1 per cent grade.

40-Ft. Safety Zone

The safety zone in front of the stands is 40 feet and inside the parking boxes are set back a similar distance. The retaining wall on both sides of the track is of concrete, 2 ft. 6 in., or 2 ft. above ground. This wall is 12 in. at the bottom and 9 in. across the top. The tire protection in front of the stands is 10 ft. netting strung on iron posts set in the retaining wall. The radius of the cement circles from the two end major axes is 1350 ft. The height of the outside of the track on the curves is 14.98 ft.

The track, which is expected to develop above 100 m.p.h., was built as follows: A sand water-settled base was slushed in, ranging from 18 in. to 8 ft. thick. This was rolled in layers of a foot by a 12-ton roller. Above this was laid a concrete base reinforced with flat expanded metal 6 in. thick, a 1-2-4 mixture of cement, sand and stone. This was covered with an inch of 1 to 1 trowel finish of cement and sand.

The forty pits are each 8 by 15 ft. abutting the 30-in. track retaining wall, separated by 2 by 4 wood partition with wood backs, equipped only with a bench seat at the rear and sand floor.

71,616 Is Seating Capacity

Total seating capacity provided is 71,616. Four grandstands are in front of the pits on the front stretch; a fifth is at the end of the backstretch and another at the second curve top. Bleachers are on the backstretch. The total frontage of the grandstands is 3672 ft. and of the bleachers 912 ft. In all there are 1840 boxes seating 11,016 persons. The grandstands seat 48,796 and the bleachers more than 10,000. The stands are frame, covered, set on wood towers of 8 by 8 timbers and 2 by 6-in. crossbeams, fully braced in both directions with a carrying capacity of live load of 150 lb. to the square foot.

The boxes are 6 by 8 ft. with rise of 8 in. in each case and 24 in. for the last tier. Between the tiers are 6 ft. walks. In each box are six armchairs. The grandstand seats have iron hand rails and small opera backs. Thirty-six official garages are in a frame building, each 12 by 16 ft. with folding front door, back of the main grandstand.

Automobiles gain entrance to the grounds at six points and to the oval by three subways. Back of the main grandstand is free parking space for 15,000 cars, in the oval are 2000 reserved parking spaces, and reserved room for 20,000 more. The subways are reinforced concrete, 60 ft. long and 60 ft. wide with 12, 14, and 16 ft. headway, respectively, decreasing to 9 ft. under the track. For pedestrians from the street railway lines at the backstretch is an additional subway 12 ft. wide.

Exact cost of the track and equipment cannot be known until an audit is made, but President F. H. Wheeler gives estimates as follows: Land, about 342½ acres, $175,000; grading, $100,000; track, $250,000; stands, $150,000; fences, $100,000; tunnels, $70,000; buildings, $25,000.

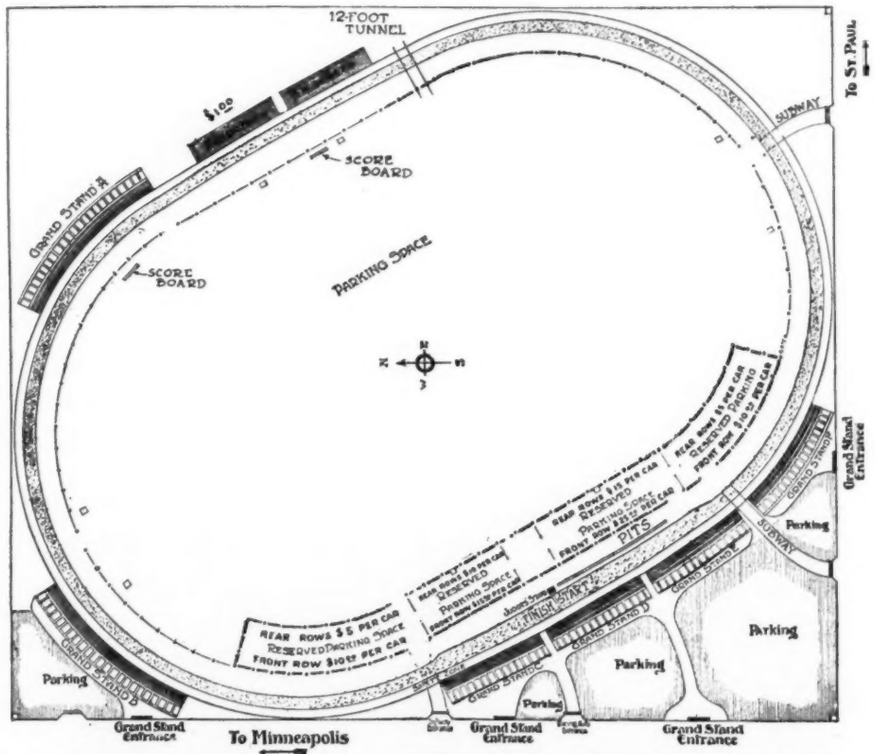


Diagram of the Twin City Motor Speedway, showing arrangement of grandstands, parking spaces, etc.

THE AUTOMOBILE

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Making Meetings Pay

THE Society of Automobile Engineers is to be congratulated that it has so active an offspring of the main body as the Detroit Section, which has just formally announced its occupancy of permanent quarters with a paid secretary.

One year ago this section was struggling along as best it could with a more or less apathetic interest shown. To those who had the society's doings at heart it seemed deplorable that a section so advantageously situated as the Detroit branch was, in the very center of the industry, should not be commanding of greater interest and enthusiasm. The regulars put their heads together and thought over the matter. They realized that the bait must be better papers and more of them by some of the foremost engineers, a goodly number of them residing in Detroit. So they set about righting matters.

A prominent engineer was asked to give a paper on a pertinent subject. There was a surprising jump in attendance and interest. Engineers began to watch for the meetings, and to enter into the discussions. It was the beginning of a new era for the Detroit Section.

Since then the movement for a home of its own was started and successfully carried to a conclusion, thanks to the aid of some of the representative manufacturers in the industry. This but serves as a lesson for other branches of the Society.

Progress in Radiators

A CHANGE in automobile construction that has passed with little comment is the coming of the pressed-steel shell, now used on very many cars. Whether a radiator is of the honeycomb type or of the more common tubular pattern, it is equally a delicate, cellular structure containing a large number of joints and not possessed of any great mechanical strength. In fact the thinner and lighter its construction, the better will it operate as a radiator of superfluous heat.

With the pressed-steel shell this delicate bit of apparatus is suspended inside a stiff casing which protects it from weaving strains, and can be struck or pushed without injury to the radiator proper. In the old pattern, where the external portion also contained water and was made of thin sheet metal, accidental injury was easy, and the task of supporting the cooler so that frame weave could not affect it has taxed the ingenuity of most automobile engineers.

The new idea appears to be both better and cheaper, a rare combination of qualities; and thus the new style radiator ought to be written down as one of the conspicuous mechanical advances of the year.

Saving Costly Parts

WHAT is a problem of considerable importance in medium and low-priced cars is vital in vehicles selling for amounts which place them in the class of high-priced design. It might not be a matter of great importance to renew parts which are made from mild structural steels that are produced in great quantities and of uniform specifications, but when it becomes necessary to replace a part made from some high-grade electric furnace steel or some material which has cost hours of labor and taken the combined skill of metallurgists and shop workers it becomes necessary to use some means of lessening the cost to the owner of repair parts.

The ideal car would doubtless be one in which all the high-priced parts were guarded against wear by intermediate buffers of lower price and lower grade materials which were sufficiently soft to absorb the wear while the higher-priced and harder materials went unscathed. It is a fact that in spite of the average price of cars falling year by year the life of the more important and expensive parts is increasing, due to these safeguards.

Battery Exchange

THE great delay in getting the battery charged has always been one of the inconveniences which the electric car owner has been desirous of removing. With the necessity of waiting several hours while a battery is being charged under the old system, it seems hardly possible that the new idea of battery exchange, which is in reality but putting into practice what has long been foreseen, has come to pass.

S. A. E. Adopts Reports of 7 Divisions

Final Count on Letter Ballot for Standards Shows Every Suggestion Adopted

NEW YORK CITY, Sept. 1—Final count on the letter ballot for standards recommendations of the Society of Automobile Engineers has now been completed and the results show that all the suggestions as to new and revised standards which were approved at the last meeting of the Society in June were adopted by a large majority in the letter ballot. The balloting was closed on Aug. 16.

Voting members of the Society were urged to vote on all questions on which they felt technically qualified to express an opinion. Prior to adoption by letter ballot all of the recommendations in question had been approved by the respective divisions of the Standards Committee having the work in hand, by the Standards Committee as a whole, by the Council and by the entire Society at the June meeting. The vote showed that the total number of ballots cast was 154. Of these fifteen were defective for various reasons. The full report as to the detailed vote on each of the standards follows and shows that an overwhelming majority was in favor of every suggestion. The highest number of negative votes polled against any recommendation is noted as against the elimination of the gray iron casting specification. The votes counted against this numbered only seven with eighty-seven in favor of the elimination. The detail report follows:

SIXTH REPORT OF CARBURETER FITTINGS DIVISION

	Yes	No
Flanges for ½ in. and ⅝ in. carbureters	87	0
Flanges for 2½ in., 3 in. and 3½ in. carbureters	83	2
Carbureter air heater	78	8

SEVENTH REPORT OF ELECTRICAL EQUIPMENT DIVISION

	Yes	No
Bulb bases, sockets and connector plugs	85	3

SECOND REPORT OF ELECTRIC VEHICLE DIVISION

	Yes	No
Motor voltage	55	5
Motor name-plates	60	2
Number of cells in standard battery equipment	56	4

SEVENTH REPORT OF IRON AND STEEL DIVISION

	Yes	No
Revised vanadium steel specifiations	90	2
Specification 3330—nickel chromium steel (new)	91	1
Revised steel castings specification	88	2
Elimination of gray iron casting specification	87	7
Revised notes and instructions on steels, etc	92	1

SIXTH REPORT OF MISCELLANEOUS DIVISION

	Yes	No
Flat fan belt and pulley widths	95	1
Cotter pin sizes	101	1
Brake lining sizes	85	5

FOURTH REPORT OF SPRINGS DIVISION

	Yes	No
Nomenclature of cantilever springs	89	3
Tests for parallelism of eyes and master leaf	88	2
Eye bushing and bolt tolerances	86	2
Wrapped eyes	87	1
Width of spring ends	87	3
Frame brackets	84	4
Offset of center-bolts	86	1
Nuts for spring clips	85	4
Center-bolts	84	1
Center-bolt nuts	83	2
Spring widths	82	4

REPORT ON BELL HOUSINGS

	Yes	No
Number of bolts	73	4
Flange widths	75	2
Bolt hole circle	73	2

October Standards Committee Meeting at Chicago Athletic Club

NEW YORK CITY, Sept. 1—Meeting dates and places for the October Standards Committee meeting and the meeting of the entire organization for the 1916 winter session are announced by the Society of Automobile Engineers. The headquarters of the Standards Committee meeting to be held in Chicago on Oct. 14 will be the Chicago Automobile Club. In all probability there will be an afternoon as well as a morning session, the opening being at 9 a. m. Reports will be made by several divisions of the Society and the meeting will probably be attended by many members.

The divisions which will in all probability have progress reports to make are those dealing with electric vehicles, the miscellaneous division, truck standards and foreign co-operation.

The electric vehicle division will, in all likelihood, report again on speed and mileage ratings and on specifications involved in the assembly and operation of battery-propelled cars.

The miscellaneous division has still to report upon a number of subjects, including universal license plates, position of motor numbers, expression of car weight, air pump bases, water hose and hose clamp dimensions.

The truck standards division and the foreign co-operation division which was formerly known as the International Standards Division will, according to the present schedule, submit some important matter with regard to solid tire equipment in this country and abroad. These divisions will hold a joint meeting at the office of the Society in New York on Sept. 7 for the purpose of considering data relating to industrial truck standards, smaller than 36-in. diameter tire, branding of millimeter equivalent dimensions on solid tires, universal standards for truck tires and wheels, actual deviation from nominal tire tread diameter, carrying capacity table, ½-in. felloe band thickness for 6-in. dual tires and trailer hitch.

Small Waverly Truck Coming

INDIANAPOLIS, IND., Aug. 27—It is stated on good authority here that the Waverley Co. of this city will in the future announce a new electric commercial model of light capacity at a lower price than heretofore Waverley vehicles have been offered.

S. T. Davis, Locomobile Head, Dies

Connected with Industry Since 1899—Had Been Locomobile President Since 1902

BRIDGEPORT, CONN., Sept. 1—S. T. Davis, Jr., president of the Locomobile Co. of America, died here at 2 o'clock last night from hemorrhage of the brain. Mr. Davis was taken ill on Saturday with what appeared to be acute indigestion but a hemorrhage occurred on Monday and his condition became rapidly worse.

Mr. Davis, who had been connected with the automobile industry since June 13, 1899, the date on which he used his first car, was born in Washington, D. C., Feb. 8, 1873. He entered Columbia College preparatory school and took the degree of civil engineer from the Rensselaer Polytechnic Institute, Troy, N. Y.

In 1900 he started as treasurer of the Locomobile Co. of America, under A. L. Barber, a position which he held for 2 years, after which he became president, an office which he held up to his death. Mr. Davis was one of the organizers of the National Association of Automobile Manufacturers in 1900 and was its first president. Since that time he was on the directorate of this organization and its successors, the National Automobile Board of Trade and the National Automobile Chamber of Commerce, Inc.

Mr. Davis had a number of interests outside the automobile industry, being a director in several companies and being interested in real estate and banking to a considerable extent.

He was a member of the following clubs: New York Yacht; Automobile Club of America; Ardsley Club; Brooklawn Country Club; Automobile Club of Bridgeport; Algonquin; Seaside; Bridgeport Yacht Club; the University Club in Bridgeport, and the University Club in New York.

New Olds Model at $1,162.50 for Southern States

LANSING, MICH., Aug. 30—The Olds Motor Works are now supplying dealers in the Southern States and in other parts of the country with a special model wide tread four-cylinder Oldsmobile 43, the price of which is $1,162.50 for either the roadster or touring car. This model is fitted with specially constructed wire wheels finished in red light enamel and by the use of an extra wide tread on the wheels it is not necessary to lengthen the axle shafts.

Heinze Co. Enters Starter Field

To Open Plant in Springfield, O.—Begins Work in 60 Days

SPRINGFIELD, OHIO, Aug. 30—The John O. Heinze Co., recently formed to make electric self-starters in this city at the Shuey factories' building, is preparing to employ a force of 300 men, it is reported. Associated with Mr. Heinze is William Pflum, who was formerly vice-president and general manager of the National Cash Register Co.

Mr. Heinze is vice-president and chief engineer of the company. Before coming to Springfield, Mr. Heinze was chief engineer of the Northway Motor Co., Detroit.

The company has taken out patents on an electric starter, for lighting and ignition apparatus. The company will manufacture these apparatuses in large quantities. The company expects to begin the manufacture of its products within sixty days.

The company has brought a number of men from Detroit and other cities. Among these are: Paul Arthur, former assistant engineer of the Continental Motor Co., Detroit; Gordon Reid, formerly assistant to chief engineer Dunham of the Chalmers Motor Co., and John Boone, electrical engineer of Detroit. Mr. Arthur is head of the designing department and Mr. Reid is in the efficiency department. Mr. Boone is electrical engineer and chief of the laboratory. William Pflum is president and general manager.

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S. A. E. Sections Active in September

NEW YORK CITY, Sept. 1—The month of September starts the activities of the Society of Automobile Engineers. The Detroit, Indiana and Metropolitan sections have all announced their meeting topics and the dates and places have also been decided. Another section activity which may soon take place in connection with the meeting of the Standards Committee at Chicago in October is the inauguration of a Chicago section.

The Metropolitan Section will hold its meeting at the Automobile Club of America, New York City, on Sept. 16. Leon Goldmerstein, a member of the Aeronautical Society and associate editor of the Journal of the American Society of Mechanical Engineers, will present a paper on the aeroplane. In addition H. G. McComb, chairman of the Research Committee of the section on governors will submit the final report of this body for discussion.

On the same night as the Metropolitan Section meeting the Detroit section will open its program at the Ponchartrain Hotel with a paper by J. G. Vincent entitled "A Discussion of the Twin Six Motor." The entire technical section will be devoted to the reading and discussion of this paper.

On Sept. 24 the Indiana section will also hear a paper by Mr. Vincent and in addition James E. Diamond will talk on aluminum pistons. The meeting will be held in the rooms of the Hoosier Motor Club at the Claypool Hotel.

Winter Meeting in Show Time

The 1916 winter meeting of the Society of Automobile Engineers will be held in New York in the first week of next year, during the automobile show. It is the intention of the Meetings Committee and the Council that the coming national sessions shall be fewer in number than heretofore and be the occasion of the presentation and discussion of papers of marked interest and value to automobile engineers. Features of the technical program, which will include consideration of reports of various Divisions of the Standards Committee, are now being arranged. The members are requested to express their views as soon as possible as to what subjects it is desirable to have treated at the coming meeting. It is requested that in sending suggestions rather full outlines of the proposed papers be given, including the naming of preferred authors.

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To Make Four-Wheel-Drive Automobile Chassis

ST. PAUL, MINN., Aug. 30—The Twin City Four-Wheel Drive Co., recently incorporated with a capital of $500,000, to manufacture four-wheel drive trucks, will also make a chassis for automobiles on the four-wheel-drive principle. The company has opened temporary offices at 2334 University Avenue, S. E., Minneapolis. Announcement of the formation of the company and its factory plans was made in THE AUTOMOBILE for Aug. 26.

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Maxwell Ships 250 Cars Daily

DETROIT, MICH., Aug. 31—The Maxwell Motor Co., Inc., is shipping daily from its Detroit plants 250 cars of the 1916 model, a marked increase over previous production records.

"Reports from our dealers throughout the country," said sales manager C. E. Stebbins of the Maxwell company, "indicate that our estimates as to our 1916 output is already about 10,000 cars under what it should be. In other words, to date our dealers have asked for nearly 10,000 more cars than their contracts call for."

New Madison Six Is on Market

Has Rutenber Motor—Seven-Passenger at $1,085—Five, $985

ANDERSON, IND., Sept. 1—*Special Telegram*—A new six-cylinder model has been brought out by the Madison Motors Co., this city. It uses a Rutenber six-cylinder block motor, 3 x 5 in., with Remy starting and ignition system, the ignition being the Remy magneto type distributer. Motor and gearsets are unit with the flywheel entirely inclosed with 120-in. wheelbase and 34 by 4-in. tires. The car sells as a seven-passenger touring car at $1,685 and either a five-passenger touring car or two-passenger roadster at $985. Axles are made by the American Gear & Mfg. Co. and clutch and gearset by Detroit Gear & Mfg. Co. Steering is by Warner reversible and full gear. Stewart vacuum gasoline system is used and equipment is complete.

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Daniels to Build Eight

READING, PA., Sept. 1—*Special Telegram*—A new eight-cylinder car will shortly be brought out under the name of the Daniels eight from a factory in this city by Geo. E. Daniels, formerly vice-president and general manager of the Oakland Motor Co., Pontiac, Mich. It is expected that the new car will use a Herschell-Spillman motor, and will be virtually a custom-made job, the streamline body being made in five- and seven-passenger models and in the touring design with center cowl as well as inclosed types. The wheelbase is given as 127 in., and the price will be in the neighborhood of $2,350.

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Polhamus Resigns from Bowser

SOUTH BEND, IND., Aug. 28.—A. Z. Polhamus, chairman of the executive board of the S. F. Bowser Oil Tank & Pump Co., Fort Wayne, has resigned from that position after serving the company in various capacities for 25 years. He started with the firm in 1890 as superintendent of salesmen, later becoming assistant manger. He was a stockholder, a director and secretary-treasurer of the firm when it was incorporated in 1898. In 1904 he was chosen general manager and held that position until 1914, when he was made chairman of the executive board. His health during the past few years has demanded open-air activities and he became interested in horticulture. As the affairs of the concern are in good condition at the present time, he has decided to retire. He will retain his financial interest in the company.

Trade Review of the Week

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Detroit Factories Struggle to Keep Up with Demand—Dealers Optimistic

DETROIT, MICH., Aug. 31—Last week the Detroit automobile industry still continued to exert every influence that would aid in the production of the maximum number of cars. Everywhere the demand has remained as stiff as ever, and in some instances it is claimed that dealers could take more cars than they have contracted for. It is evident that many estimates of certain dealers' allotments of cars should have been larger to take care of the trade, but it is almost impossible for the majority to increase the number contracted for, since the factories' schedules have been based upon dealer contracts, and with a place for every machine it looks now like a forlorn hope for any of them to expect to get more vehicles than their contracts stipulate.

Healthy Production Conditions

As an indication of how things are going with some of the big factories, Dodge Bros. is now in about as healthy a production condition as it has been so far since beginning the making of a car under the Dodge name. The daily output is between 235 and 250 cars. Last week Packard announced that it is carrying the largest payroll in its history—about 8200 men. The factory is practically ready for the quantity production of the new car, and motors and various parts are now coming through rapidly. Customers' cars will start to come along in about two weeks. Maxwell reports unprecedented demand from dealers and is making 250 cars a day.

Another Cable Order

The Scripps-Booth Co. last week received another cable order from England, this for 500 more cars, it is said. As the concern has already shipped some 400 to this dealer, the foreign business is assuming large proportions.

Chalmers is also breaking records, the Six-40 model receiving a good reception, especially through the East. Last week two trainloads of Chalmers cars were shipped to the New York branch, as an indication of the quantity trend of the business.

Foreign Trade Grows

There can be no doubt that foreign business is outstripping all expectations of a few months ago. Those concerns who already have good foreign representation are doing their utmost to deliver cars to these agents, principally in England, and others are contracting for this invasion of the hitherto small market abroad. Many of the well-known London dealers have come over to make the best connections they can. One of the most prominent of the Detroit makers, who up to this time has had no English sale, has closed with a prominent Britisher for a considerable number of vehicles.

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Aug. Sales for N. Y. Break All Records

NEW YORK CITY, Aug. 31—The month of August has closed with record sales for the local automobile dealers. Never before in the history of the dealers has the automobile-buying public been so urgent in its demand for cars. August has in former years been considered a slack month, and the dealers had to wait usually until the middle of September or the beginning of October before trade picked up. This year, however, August sales have been on a par with those of March, April, and May.

Business for September and October is expected to break records. Just at present the dealers are beginning to catch up on their deliveries and in a majority of cases, especially in the small car field, shipments are coming in regularly. The buying public consists of farmers from Long Island and New Jersey, and hundreds of people who already own cars, but who either want small or large cars for their separate uses.

Last week the dealers were busy getting in their closed cars and to anticipate inquiries for these cars, the majority of them had new catalogs on their tables describing the new models in winter cars. A large sale is already reported in closed bodies.

The small cars in August made very good sales. The Maxwell company sold ninety-one cars during the month. The Saxon company reports one of the best retail months, having sold sixty cars retail. Many inquiries are being made on its coupes and sedans. The agency expects a rush business until December.

The Hupp agency is just beginning to make deliveries. Sales in August amounted to twenty-eight. It is 123 cars behind in orders. It expects a 100-per cent increase in business in September.

Demand for Closed Cars

The Chandler company reports the largest month it ever had, having sold 109 cars to date, which is about 70 per cent better than last year's sales for that month. The agency expects a big demand for closed cars and at present, in anticipation of this demand, has several special closed bodies on its floor.

Cadillac sales were much above normal, almost doubling last year's mark. Sales during August were equal to the best months since January. The company is doing a large business in closed cars.

Shipments are coming in regularly for the Franklin agency, which is now getting two carloads a week. Sales last month were between thirty and forty.

Sales in the National and Jeffery cars were about 200 per cent better than those in the same month last year. The agency reports the same complaint of a number of the other dealers, a scarcity of cars.

The Ford service station in Long Island City delivered 1200 cars last month. Shipments, however, were small and as a consequence the station was approximately 1600 cars behind in deliveries.

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Rains Hurt St. Louis Sales—Repairmen Reap Harvest

ST. LOUIS, MO., Aug. 28—The solid week of record-breaking rain and the resultant floods from which St. Louis in particular and the greater parts of western Illinois and eastern Missouri in general are just recovering had a strong but diverse effect upon the automobile industry in this district—it hurt the automobile dealer and benefited the repair and accessory man. In fact, for the time being, it almost ruined the business of the former and yet it boosted almost beyond estimation the prosperity of the latter.

The situation from the dealer's standpoint was well summarized by George Weber, president of the Weber Implement & Automobile Co., who happened to be touring the stricken district when the storm came.

He said: "There are no roads left at all in some districts. The washing away of bridges has completed the demoralization of vehicle traffic and many days will pass before conditions are normal. Where the torrent has not obliterated roads it has washed out the surface and this will necessitate extensive repairs.

"We could bear all these troubles with equanimity, however, if the crops were not seriously affected by the rains and floods, but early reports indicate heavy damage has been done. In many cases, wheat, which had been cut and was lying in the field awaiting threshing, was washed away."

The repair and garagemen, on the other hand, have been busy day and night ever since the water began to recede in pulling mired and submerged machines to town and overhauling them. The accessory men have been working day and night selling new parts to car owners whose machines were caught in the deluge.

Lansing Factories to Double Output

Reo and Olds Cos.' Schedule 40,000 Cars—Export Trade Grows

LANSING, MICH., Aug. 28—The two big local automobile manufacturing plants, the Reo Motor Car Co. and the Olds Motor Works, are scheduling an output of about 40,000 passenger cars for the season 1916. This is double the 1915 output.

During the business season just ended, the Reo Motor Car Co. sold 17,500 cars. For 1916 the production schedule calls for at least 25,000 cars. According to assistant sales manager Harry Lee, dealers have thus far contracted for more Reo cars that the total number sold the past season.

The Olds Motor Works are planning to make from 12,000 to 14,000 cars for the next season. During the 1915 season between 4000 and 5000 Oldsmobiles were sold, according to assistant sales manager N. W. Barton.

The export business of the Olds works is expected to become an important part of the general business from now on. During the past few days orders have been received from Australia, South Africa and England. The order from the latter country is for 600 passenger cars.

Refined Walker Electrics $615 Lower in Price

CHICAGO, ILL., Aug. 27—In its line of 1916 electrics the Walker Vehicle Co., this city, is listing four models, three of which sell for $1,985, as compared with $2,600, a reduction of $615 over a year ago. These models embrace a wide choice of body and are all built on 96-in. wheelbase chassis. The fourth model is on a 104-in. chassis and lists at $2,150 as compared with $2,800, a reduction of $650. This is a five-passenger limousine which is roomy in dimensions.

Refinements have been made in the body work on all models, principally in the use of more aluminum in the weather-exposed parts, sashless windows, mechanical window raisers of the lever type and a number of detail improvements in fittings and equipment.

Baker Wheels and Rims Succeed in R. A. C. Tests

LONDON, ENGLAND, Aug. 19—Certificates have just been issued by the Royal Automobile Club, concerning tests which have been made on the Rebak rims manufactured by the Baker Rim Co., Stourbridge. The tests were first on the road and then in the shop to determine the solidity of the rim of the wheel and the time required for removing and replacing it. A distance of 1000 miles on the road was covered and the average speed 20 m.p.h. The car weight was 4095 lb. with a load of 1.674 lb. on the front axle and 2421 on the rear.

The size of the tires was 820 by 120 mm. (32 by 4.7 in.) and the inflation was about 60 lb. to the square inch. No security bolts were used. On examination at the conclusion of the trial, according to the report, the rims were found to be firmly fixed upon the wheels and there was no sign of movement having taken place. The rims with the tire in place were then removed and replaced upon the wheels, with the time taken for the operation. These times are given as follows:

Wheel	Removal	Replacement
Left rear	10 sec.	11 sec.
Right rear	12½ sec.	13½ sec.
Left front	10 sec.	11 sec.
Right front	15 sec.	9¾ sec.

Subsequently the tire was removed from the rim which had been upon the left rear wheel and the time was 11½ sec. Four new tires were then placed upon the rim and the time for fitting and removal was as follows:

Make of Tire	Fitting	Removal
Dunlop	1 min. 20 sec.	14 sec.
Michelin	0 min. 58 sec.	7½ sec.
Palmer	2 min. 28 sec.	15 sec.
Clincher	1 min. 35 sec.	10 sec.

After the trials the rims were found to be in good condition and had not rusted and the water had not entered beneath the beads. There was no sign of creeping either of the tire upon the rims nor of the rims upon the wheels.

The Rebak detachable wheel also made by the Baker Rim Co. was made the subject of R. A. C. tests the route covered being 1000 miles with a Ford car. This car on the scales showed a weight of 1688 lb. with the average running weight throughout the trials of 1860 lb. During the last 31 miles of the trial the retaining nuts and lock nuts were intentionally loosened on all four wheels and tightened with the fingers. At the conclusion the retaining nut was tight with the lock nut loose on the left rear, both nuts tight with wheel loose on the right rear, retaining nut type lock nut loose on left front, both nuts tight but wheel loose on right front.

Duplex Power Car Co. Elects

CHARLOTTE, MICH., Aug. 27—At a meeting of the stockholders of the Duplex Power Car Co. the following board of directors was elected: James H. Brown, W. H. Cooley, Horton H. Bryan, M. J. Lamson, A. M. White, Frank T. Town, Frank L. King. Executive officers will be elected Sept. 8. It was announced that an order for 200 trucks from Denmark had been received but had to be declined as the orders on hand would not permit this order being completed within four weeks as specified.

Drummond to Make 4 and 6

Omaha Co. Will Assemble Cars in Its Present Plant—Ollier Promoted

OMAHA, NEB., Sept. 1—*Special Telegram*—The Drummond Motor Car Co. has been organized in this city to manufacture the Drummond four- and six-cylinder car. The Drummond Co. has been in existence for twenty years, and will assemble cars in its present plant.

Ollier a Studebaker Vice-President and Director

NEW YORK CITY, Sept. 1—At a special meeting of the Studebaker Corp., held last Friday, L. J. Ollier was elected a vice-president and director. His present promotion takes him from the position of sales manager to a vice-presidency that carries the duties of sales director.

H. R. Benson has resigned as vice-president and a director of the corporation to become distributor of Studebaker cars for the State of Maine and a part of New Hampshire. He will make his headquarters in Portland, Me.

Watson Is Haynes Sales Manager

KOKOMO, IND., Aug. 6—D. L. Watson has been appointed general sales manager of the Haynes Automobile Co. to succeed R. Crawford, who has resigned. Mr. Watson was formerly assistant sales manager and has been associated with the company for 14 years.

Coghlan Leaves Klaxon for Moon

NEW YORK CITY, Aug. 30—R. G. Coghlan, eastern sales manager of the Lovell-McConnell, Mfg. Co., has resigned his position to become associated with the Moon Motor Car Co. of New York, in the capacity of district manager.

Pennsylvania Tire Prices Reduced

NEW YORK CITY, Sept. 1—The Pennsylvania Rubber Co. has reduced the prices of its smaller sized vacuum cup tires, effective to-day. The following list gives a few of the new prices: 28 x 3, $12.65; 28 x 3½, $15.40; 30 x 3½, $16.20; 30 x 4, $19.55, and 31 x 3½, $16.90.

Pullman Opens New York Branch

NEW YORK CITY, Aug. 31—The Pullman Motor Car Co., York, Pa., has opened a factory branch at 1892 Broadway, this city. A full line of the latest models will always be on exhibition as well as a complete stock of repair parts for all models. Henry Drouet, formerly with the Pullman Sales Co., this city, will be in charge of the branch.

Sell Electrics Without Batteries

Walker Co. To Deduct $270 When Batteries Are Omitted —Movement Grows

CHICAGO, ILL., Aug. 31—*Special Telegram*—The Walker Vehicle Co. will sell its 1916 Chicago electric passenger cars with or without batteries, deducting $270 when sold minus the batteries. Arrangements are being made to rent batteries in this city at $20 per month the first year and $16 per month the following years. The concern renting batteries agrees to keep them in repair and if the battery capacity falls below 80 per cent, it will renew the parts free.

A National Movement

NEW YORK CITY, Aug. 31—That the electric vehicle business in this country, both as regards passenger and commercial cars, is on the threshold of a change, is the opinion of many in the industry. What changes are expected to take place are directly traceable to the practice which is rapidly coming into vogue of renting battery service. This, in turn, has made it possible for dealers to sell electric cars without battery equipment and naturally enables them to quote prices all the way from $200 to $900 less per vehicle, depending on the style and size. What the reduction in price will enable the electric car dealer to accomplish and what the battery rental service will do in the way of making electric cars more desirable both for pleasure and commercial use are at the present time sources of considerable speculation among those engaged in this business throughout the country.

Demand Growing

It has been the experience with practically all dealers in electric cars that lately there has been a growing demand for cars without the batteries. This has been especially true in certain New England centers and in the Middle West, although in New York no appreciable demand for cars without this equipment has made itself felt. In Hartford, Conn., about 3 years ago, the practice of renting battery service was inaugurated by several of the charging stations and has proven itself to be a success.

Opens Manufacturers' Eyes

The idea worked out by the General Vehicle Co. and Electric Storage Battery Co. in and around Boston, whereby electric truck users may purchase vehicles without batteries and buy battery service at a fixed charge through the interchangeable battery scheme has opened the eyes of manufacturers to at least some of the possibilities of reciprocal arrangements. This interchangeable idea has also been carried out in San Francisco, Spokane, Baltimore, Worcester and other centers and seemed in all cases to work out excellently. The result has been that the fever has spread throughout the field and many have gone so far as to predict that the battery proposition will work itself out on the same basis practically as the Prest-O-Lite tank arrangement, whereby the owner of one of these tanks is able to secure renewals at a nominal cost. The only difference between the two ideas seems to be that the battery will not have to be purchased, but rather a fixed charge made for the service.

Universal Renting System

While as yet it is impossible to indicate a concrete and fixed idea on how the interchangeable battery renting scheme is going to work out on vehicles which are so difficult to standardize, there are many in the industry who, although they do not desire to be directly quoted, are extremely optimistic as to the eventual outcome. It is said that a Chicago man who has taken out a series of patents on different methods of effecting the battery exchange system has secured the co-operation of several New York agents who have gathered together and worked out what may turn out to be a feasible universal battery renting system. This system and its working plans, it is stated, will be all ready for public announcement within 2 or 3 weeks. The most optimistic of those who have studied the plan state that they would not be surprised if some of the gasoline car manufacturers, especially in the truck business, would go into the business of building electric chassis for commercial use with standard battery mountings.

Mileage and Price Limitations

According to the views of the believers in the battery rental system, the only factors working against the development of the electric vehicle industry are the mileage limitation and price. With the battery rental system giving all the mileage desired and the practice of selling the car without the battery giving the reduction in price the idea is that these two factors will be largely overcome. One of the other advantages claimed is that a car in commercial service or even in touring use need only carry a battery of sufficient size for its desired trip mileage, thus a car on a 100-mile trip will take a 100-mile battery while on a 25-mile trip. When asked regarding the demand for cars minus battery in New York City the representatives of the electric car interests here all stated that while there has been no appreciable demand here, in other parts of the territory there is an indication that the practice of battery rental is growing.

Glide to Concentrate on Six

Five-Passenger Design with 3 by 5 Block Motor Has Modern Equipment

PEORIA, ILL., Aug. 30—One of the concerns to join the ranks of six-cylinder builders for the 1916 season is the Bartholomew Co., maker of the Glide car. This concern has dropped the Glide 30 of 1915 and will concentrate on the 1916 Six-40. The new car is a five-passenger design selling for $1,095, and is an assembled design, having a Rutenber 3 by 5 motor with the cylinders cast in a block. Other specifications of the car include positive water circulation by centrifugal pump, Westinghouse electric lighting, starting and ignition, disk clutch, three-speed gearset and Hotchkiss drive. The rear axle is floating with a pressed steel housing and the driving gears are carried in a cast steel carrier. Both brakes are on the rear wheels with 14 by 2 in. drums. Steering is by screw and nut with an 18-in. wheel.

Up-to-date equipment is used throughout. The gasoline feed is by the Stewart-Warner vacuum system, the wheels are provided with Goodyear demountable rims and 34 by 4 in. tires, the top is a one-person design with Jiffy curtains and the instrument board is fully equipped, including a Stewart-Warner magnetic speedometer driven from the propeller shaft, an ammeter and a dash lamp.

There is a detachable sedan top, which gives an all-year-round equipment if so desired. The Glide sedan top is constructed with a frame of hard wood, ironed and braced against squeaks and rattles. It is upholstered in Bedford cord and has double strength glass in the doors and windows. There is an electric dome light in the top. This body can be removed or attached by two men in an hour. The touring body to which this may be fitted is a full streamline design with the modern yacht-like sweep from the headlights to the rear of the body. The upholstery is enamel leather over curled hair and oil-tempered springs. The wheebase is 119 in.

Proposed Denver Special-Tax Ordinances Favor Garages

DENVER, COL., Aug. 28—Two special-tax ordinances affecting the automobile business in Denver have been introduced in the City Council this week, and both are expected to pass when they come up for final action at the next meeting of the Council.

One provides for a $25 yearly license fee for all public garages, and the other

requires an annual license fee of $25 additional for each curb pump.

Through the efforts of the Automobile Trades Association of Colorado, the license fee for garages was reduced from $50, which the original bill provided. This organization was also instrumental in securing the introduction of the bill permitting curb pumps within specified districts. These curb pumps will be allowed throughout the residence portion of the city, but will be barred from the main part of the business district on account of congested traffic conditions.

There are now approximately sixty-five regular garages in Denver coming under the license requirements.

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Injunction Against Splitdorf Denied

TRENTON, N. J., Aug. 27—The injunction sought by Sidney S. Meyers, a stockholder of the Splitdorf Electrical Co., Newark, against that company to restrain it from paying $1,000,000 for a patent on a high-tension magneto to the Sumter Electrical Co., Sumter, S. C., has been denied by Vice-Chancellor Backes in the Chancery Court, to-day. Mr. Meyers, who thought the payment too large, will make an appeal. In connection with the purchase of the Sumter company's patent the Splitdorf company planned to acquire the Southern concern.

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Dimming Ordinance in Kansas City

KANSAS CITY, MO., Aug. 28—The council has passed a new dimming ordinance, providing that the main shaft of light shall be confined to a minimum spread and that the uppermost rays shall not be more than 6 ft. above the surface at a point of 100 ft. ahead, and the shaft shall be directly ahead of the vehicle. The penalty is $1 to $100 fine, or five to sixty days in jail, or both. Thirty arrests were made under a previous dimming ordinance, but the persons were released and not tried because of defects in the ordinance.

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N. Y. Taxicab Co. Upheld

NEW YORK CITY, Aug. 6—An injunction has been granted by Justice Callaghan in favor of the Haverty Taxicab, Inc., which will restrain the police from arresting the chauffeurs employed by the company who operate their machines without meters.

The justice held that until the question is finally passed on by the higher courts the company should be allowed to use machines, with or without meters, as it sees fit, without interference on the part of the police. The company operates taxicabs without meters upon call from private garages, and holds that its cars do not have to be licensed under the public hack ordinance as in the case of motor vehicles soliciting patronage on the street.

Michelin French Plant Rushed

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Produces 6000 Tires a Day—Other Activities—Trouble with Solids in Field

CHICAGO, ILL., Aug. 28.—American automobile business men returning from Europe give many interesting sidelights on the situation so far as automobiles in the war are concerned. F. V. Springer, head of the export department of the Republic Rubber Co., states that at the Michelin tire factory in France 6000 pneumatic tires are being produced daily, this company not manufacturing any solids. In the valve plant of the factory 500 high explosive shells are being produced daily, and 8000 fuses. In addition, the company is producing artillery wheels and is taking up the manufacture of aeroplanes.

Last year the Michelin company made a check extending over a period of 2 months on all of the cars operating in France and Italy, the result of which shows that 80 per cent of all the cars in France last year were fitted with Michelin tires and 70 per cent of those in Italy also. Fully 80 per cent of the tires used in France have steel-studded treads, the French car owner not yet being convinced of the merits of the different types of anti-skid rubber treads used by Americans.

In northern France considerable difficulty has been experienced in the solid tire field by tires on military trucks separating between the tire and the base. This is largely due to the heavy loads carried and the high speeds, it being quite common for trucks overloaded to be driven 140 to 150 miles a day. This means higher speeds than heretofore necessary in truck use, and has proved disastrous to tires. Tire makers at the present time are trying to cope with the situation. In Italy factories are exceptionally busy, Fiat devoting the majority of its time to the production of motor trucks, which is at the rate of 40 per day at present.

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Traffic Mgrs. to Consider Extra Demurrage

NEW YORK CITY, Aug. 31—At the meeting of factory traffic managers and members' representatives to be held in Detroit, Sept. 14, at the Detroit Board of Commerce, as announced in THE AUTOMOBILE of Aug. 29, such matters as extra demurrage, or storage charges on automobiles held in freight cars at destination, will be considered. Another important point that will be brought before the meeting will be whether batteries can reasonably be considered a component part of engine starters and subject to the same rates; also, damage to automobiles by sparks and cinders entering cracks around doors of freight cars. The effect on automobile shipments of the ruling by express companies that carload rates do not include wagon service and that such shipments are subject to extra switching charges will be considered. Advertising matter on freight cars, and recommendations to be made to the Uniform Classification Committee regarding the classification of various items will also be looked into.

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Pennsylvania Has $138,406,000 in Cars

HARRISBURG, PA., Aug. 30—At the rate of $1,000 per car, there is $138,406,000 invested in motor vehicles in Pennsylvania. The registration to date is 138,406, and the number of trucks is 7453. The registration of cars thus far this year runs as follows: Under 20 hp., 14,543, against 11,107 last year; between 20 and 35 hp., 112,703, against 75,709; between 35 and 50 hp., 10,655 against 9759; cars over 50 hp., 639 compared with 585 last year.

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Detroit Body Pays $111,000

DETROIT, MICH., Aug. 28—The Security Trust Co., trustee for the Detroit Body Co., has been allowed to pay secured claims totaling about $111,000. Of this amount a mortgage of $75,000 will be paid to the First and Old Detroit National Bank and a mortgage of $36,000 to the Detroit Trust Co.

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No Glare for Washington

WASHINGTON, D. C., Aug. 28—The district commissioners have adopted an amendment to the police regulations granting permission to use electric or acetylene headlights or sidelights on automobiles and motorcycles. The lights are to be allowed, however, only on condition that they are equipped with anti-dazzling devices approved by the chief of police.

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Indianapolis Co. to Make Carbureter

INDIANAPOLIS, IND., Aug. 27—Papers of incorporation have been filed by the VanBriggle Motor Device Co. with $150,000 capital to manufacture a new carbureter invented by L. H. VanBriggle. The incorporators are: L. H. VanBriggle, H. S. Rominger, Z. F. Harshbarger, U. Z. Wiley, Frank Bivens, R. E. Hosea and E. O. Null.

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Flaum Shock Absorber Assigns

NEW YORK CITY, Aug. 30—The Flaum Shock Absorber Corp., manufacturer of shock absorbers, at 1876 Broadway, has made an assignment to H. I. Barnett. The company was incorporated on Jan. 8, 1915, with a capital of $20,000. S. M. Halper is president, and C. A. Most treasurer.

United Kingdom Continues to Lead in Car Imports from United States

Takes 2246 Cars Worth $4,413,387 in June as Compared with Only 240 Cars Worth $239,274 in June, 1914—France Takes 969, or 826 More Than Last Year

WASHINGTON, D. C., Aug. 28—The tremendous gains made in our export trade in automobiles, cars and parts during the last fiscal year are vividly shown in detailed figures issued this week by the Department of Commerce. The gross figures were published exclusively in THE AUTOMOBILE for Aug. 12.

The United Kingdom holds first rank in the volume of its imports of cars from this country. During June last the number shipped to that country was 2246, valued at $4,413,387, while in June a year ago the number was only 240 and the value $239,274. During the twelve months ended June, the number of cars exported to the United Kingdom increased from 7222, valued at $5,853,127, in 1914, to 13,934 cars, valued at $21,149,552.

The shipments to France in June last amounted to 969 cars valued at $2,634,338, as against 143 cars, valued at $88,874, exported in June, 1914. During the fiscal year these exports rose from 1429 cars, valued at $924,130, in 1914, to 5441 cars, valued at $13,776,752, in 1915.

Italy's Imports Decrease

Italy's imports of cars from this country show a sharp decline from seventeen cars, valued at $13,801, in June a year ago, to four, valued at $2,893 in June last. Even more marked was the decrease during the fiscal year, 343 cars, valued at $242,695, being shipped there in 1914, while in 1915 the number was 115 and the value $78,265.

There were no shipments of cars from this country to Germany in June last, while in June a year ago forty-four cars, valued at $56,249, were exported. During the fiscal year the number of cars exported there decreased from 1435, valued at $1,059,249, in 1914, to twenty, valued at $20,164, in 1915.

Under the heading "other Europe" large increases are to be noted. In June last the number exported to European countries not already mentioned was 1432, valued at $2,952,440, while in June, 1914, the number was 242 and the value $203,816. During the twelve months' period the number increased from 2928, valued at $2,337,733, in 1914, to 4249, valued at $10,720,541, in 1915.

Eight hundred and twenty-seven cars were shipped to Canada in June last, the value being $631,609, while in June a year ago the number was 513 and the value $642,024. During the fiscal year the number shipped there decreased from 4624 cars, valued at $5,919,776, in 1914, to 4433 cars, valued at $4,428,338, in 1915.

Mexican Trade Poor

Our export trade in automobiles with war-ridden Mexico is not very flourish-

Exports and Imports of Automobiles and Parts for June and Eleven Preceding Months

EXPORTS

Automobiles

	June				Twelve months ending June			
	1914		1915		1914		1915	
	Number	Value	Number	Value	Number	Value	Number	Value
Commercial	90	$120,257	2,990	$8,578 802	784	$1,181,611	13,996	$39,140,682
Passenger	1,982	$1,870,882	4,418	4,785,998	28,306	25,392,963	23,880	21,113,953
Total	2,072	$1,991,139	7,408	$13,364,800	29,090	$26,574,574	37,876	$60,254,635
Parts of (not including engines and tires)	.....	$473,968	.....	$1,139,182	.....	$6,624,232	.....	$7,853,183

EXPORTS BY COUNTRIES

Automobiles

France	143	$88,874	969	$2,634,338	1,429	$924,130	5,441	$13,776,752
Germany	44	56,249	.....	.....	1,435	1,059,249	20	20,164
Italy	17	13,801	4	2,893	343	242,695	115	78,265
United Kingdom	240	239,274	2,246	4,413,387	7,222	5,853,127	13,934	21,149,552
Other Europe	242	203,816	1,432	2,952,440	2,923	2,337,733	4,249	10,720,541
Canada	513	642,024	827	631,609	4,624	5,919,776	4,433	4,428,338
Mexico	3	4,577	11	13,255	167	256,675	78	81,322
West Indies and Bermuda	65	44,657	310	165,199	556	513,124	1,693	993,188
South America	76	50,683	193	119,044	1,985	1,939,212	1,264	702,163
British Oceania	425	369,693	459	399,134	4,244	3,695,595	3,186	2,670,483
Asia and other Oceania	147	149,121	735	1,849,630	2,140	2,076,278	2,316	4,557,634
Other countries	157	128,370	222	183,871	2,017	1,756,980	1,147	1,076,233
Total	2,072	$1,991,139	7,408	$13,364,800	29,090	$26,574,574	37,876	$60,254,635

Tires

Belgium	.....	.....	.....	.....	.....	$15,730	.....	.....
Germany	.....	$6,586	.....	.....	.....	132,181	.....	$6,090
England	.....	192 510	.....	$365,606	.....	1,503,440	.....	2,655,099
Canada	.....	168,976	.....	110,852	.....	961,937	.....	772,574
Cuba	.....	.....	.....	29,790	.....	.....	.....	106,083
Mexico	.....	2,577	.....	7,117	.....	111,948	.....	190,813
Australia	.....	.....	.....	64,519	.....	.....	.....	245,240
Philippine Islands	.....	14,040	.....	25,025	.....	141,205	.....	250,832
Other countries	.....	68,489	.....	135,953	.....	638,826	.....	736,539
Total	.....	$453,178	.....	$738,862	.....	$3,505,267	.....	$4,963,270

IMPORTS

Automobiles

Automobiles ..... dut.	22	$31,746	22	$34,519	300	$620,493	322	$525,303
Parts of (except tires) ..... dut.	.....	96,739	.....	81,060	.....	812,083	.....	847,109
Total automobiles, and parts of	.....	$128,485	.....	$115,579	.....	$1,432,576	.....	$1,372,412

IMPORTS BY COUNTRIES

Automobiles

France	10	$17,365	5	$6,082	134	$304,716	62	$131,936
Germany	2	2,293	.....	.....	21	45,680	6	13,606
Italy	5	5,989	4	5,385	55	79,464	111	122,446
United Kingdom	.....	.....	2	5,379	40	115.042	74	179,765
Other countries	5	6,099	11	17,673	50	75,591	69	77,550
Total	22	$31,746	22	$34,519	300	$620,493	322	$525,303

ing. In June last eleven cars, valued at $13,255, were shipped there, as against three cars, valued at $4,577, exported in June a year ago. During the twelve months' period the exports fell from 167 cars, valued at $256,675, in 1914, to seventy-eight cars, valued at $81,322, in 1915.

310 Cars to West Indies

The West Indies and Bermuda took 310 cars from this country in June last, the value being $165,199, while in June, 1914, the number was sixty-five and the value $44,657. During the fiscal year the exports increased from 556 cars, valued at $513,124, in 1914, to 1693 cars, valued at $993,188, in 1915.

Decrease to South America

Our exports of cars to South America increased from seventy-six, valued at $50,683, in June, 1914, to 193 cars, valued at $119,044 in June last, but during the fiscal year decreased from 1985 cars, valued at $1,939,212, in 1914, to 1264 cars, valued at $702,163, in 1915.

British Oceania imported 459 cars from this country in June last, the value being $399,134, while in June, 1914, the number imported was 425 and the value $369,693. During the twelve months' period these exports declined from 4244 cars, valued at $3,695,595, in 1914, to 3186 cars, valued at $2,670,483, in 1915.

Exports to Asia Gain

Our export trade in cars with Asia and other Oceania increased from 147 cars, valued at $149,121, in June a year ago to 735 cars, valued at $1,849,630, in June last, and from 2140 cars, valued at $2,076,278, in the fiscal year 1914 to 2316 cars, valued at $4,557,634, in 1915.

Under the heading "other countries" the exports amounted to 157 cars, valued at $128,370, in June, 1914, increasing to 222 cars, valued at $183,871 in June last, while during the twelve months' period the shipments declined from 2017 cars, valued at $1,756,980, in 1914, to 1147 cars, valued at $1,076,233, in 1915.

The detailed schedule of exports and imports appears on the opposite page.

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Gasoline for Export Up

NEW YORK CITY, Aug. 30—The Standard Oil Co. of New York has announced an advance of 1 cent a gallon all around in the price of gasoline for export. This brings the quotation for deliveries in 110-gal. drums f.o.b. seaboard to 18 cents a gallon. This is the first price advance in more than a year, during which time the quotation has held firmly at 17 cents a gallon. The New York company's quotations on export business are regarded as the standard, and any changes in the local company's prices are followed by the other companies doing an export trade.

$49,000,000 for Rural Delivery

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Motor Vehicles To Be Extensively Used—$2,000,000 Saving Effected

WASHINGTON, D. C., Aug. 28.—Motor car manufacturers and dealers throughout the country will find much to interest them in a statement issued by the Post Office Dept. to the effect that Postmaster General Burleson will ask Congress next December for an appropriation of about $49,000,000 to provide rural delivery during the fiscal year beginning July 1, 1916. The appropriation for the current year is $53,000,000.

$1,000,000 for New Routes

Of the $49,000,000, it is estimated that $48,000,000 will operate all the rural routes now authorized. The additional $1,000,000 will pay for new service to be established before or during the 12 months to be covered by the appropriation. The Post Office Dept., in a statement, says that the appropriation for rural delivery for the fiscal year 1913 was $47,000,000. The Postmaster General now proposes to provide a modernized and a much larger service during the fiscal year 1917 for just $2,000,000 more than the cost of the old service 4 years ago. One of the reasons why this is possible is because of the economies resulting from the introduction of the automobile in this field of postal transportation.

Automobile Service Success

The department's statement says the success of the automobile service has been fully demonstrated during the last 2 months. With one or two unimportant exceptions, in connection with which postponements of the change were asked and allowed for special reasons, the motor car has been substituted for wagon delivery, wherever ordered, smoothly and on the scheduled time. The motor service is steadily gaining in efficiency and popularity.

Many Applications

Applicants for examination for permanent places as automobile carriers average twenty to each position. In some cases as many as forty men have sought the positions, offering to supply a car, do the 50 to 60 miles a day required for 6 days a week, at the compensation offered—from $1,500 to $1,800 a year. Inasmuch as the majority of the motor car routes radiate from small communities, in which relatively few machines are available for business purposes, this showing is regarded as conclusive proof of the desirability, as well as the feasibility, where road conditions are good, of using the motor car as a carrier of rural mails. It is to be remembered, according to the department's statement, that the adoption of the motor car for this service will give a powerful stimulus to the cause of good roads and improve the facilities available to the farming population for utilizing the parcel post system.

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U. S. Rubber Imports Grow

WASHINGTON, D. C., Aug. 27—Crude rubber shipments from the principal South-American ports have shown an increase of 2,143,076 lb. for the year ending June, 1915, over the year previous, most of which surplus was imported by the United States, according to the report of George H. Pickerell, consul for the United States at Para, Brazil, to the Department of Commerce. The total rubber shipped from the three chief rubber ports of the Amazon Valley was 5,192,260 for the year ending June, 1915, as against 3,049,184 for the year previous. Of this total the United States took 3,088,114, and Europe 2,104,147. The year previous the United States took 1,035,396, and Europe 2,013,788; so that while the United States has increased its imports nearly threefold, Europe has stood practically stationary. The three ports included in these figures are Para, Manaos, and Itacaotiara. Para shipped more than two and one-half times more to the United States than to Europe; Manaos shipped the greater part of its output to Europe, and Itacaotiara shipped all of its rubber to Europe. Para ships nearly three times the amount of rubber that the other two combined do.

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S. O. Advances Gasoline Up 1 Cent in New Jersey

BAYONNE, N. J., Aug. 27—The price of gasoline in this city, where much of the supply is made by the Standard Oil Co., was raised 1 cent a gallon to the dealers yesterday and they in turn increased the price to customers. The price is now 14 cents a gallon, an increase of 3 cents within a month. It was said yesterday that there may be an increase in the prices of other oil products. Local dealers are selling Gulf gasoline at 13 cents.

Further advances have recently been announced in some of the southern States. In Alabama the price has been advanced 1 cent a gallon and in North Carolina 1 cent a gallon to 16 cents. At most Georgia points the price has been raised 1 cent a gallon to 16 cents, but in Atlanta the quotation has been advanced 1½ cents to 14 cents. In Virginia an increase of 1 cent, to 13 cents a gallon, is announced.

Packard Buys More Real Estate

Pays $75,000 for 12.8 Acres—Business Growth Necessitates Further Expansion

DETROIT, MICH., Aug. 30—Through the purchase of 12.8 acres of ground from different parties, the Packard Motor Car Co. now owns over 100 acres of real estate. The purchase price of the land was about $75,000. To what use this property will be made has not yet been definitely decided, although it may be assumed that new buildings or additions to the plant will be started ere long.

Notwithstanding the fact that the Packard company has now under construction half a dozen additions and new buildings which when completed and equipped with their machinery will represent a total expenditure of $1,500,000, the concern's business is now growing so fast that the officials found that it will be necessary to further expand in order to cope with the future.

Through this new acquisition of land the Packard company now has a strip about 1000 ft. wide and extending over one mile along the belt line railroad.

National Adds to Plant

INDIANAPOLIS, IND., Aug. 30—The National Motor Vehicle Co., Indianapolis, is building a large addition to its Twenty-second Street plant, and the improvements include remodelling of the present offices. Pending completion of same, the general offices of the company have been removed to 426 North Capital Avenue, at which address is located its local branch.

Pope Buyer Issues Stock

WESTFIELD, MASS., Aug. 29—The Westfield Mfg. Co., which recently bought the plant and business of the Pope Mfg. Co., in this city, has issued the following securities in payment therefor: $400,000 6 per cent serial debenture bonds; $400,000 7 per cent convertible preferred stock, and $800,000 common stock.

The company will continue the manufacture of cars and bicycles and will be under the direct management of W. C. Walker of Hartford. C. H. Tenney of Springfield, Mass., will be chairman of the board, and the other directors will be Joseph Shattuck of Springfield, O. J. Thomen of Redmond & Co., and S. C. Millett of Millett, Roe & Hagen.

Redmond & Co. underwrote the preferred stock and Millett, Roe & Hagen took the bonds, all of which have been placed with investors.

Tin Prices Active

NEW YORK CITY, Aug. 31—The last week proved no exception to the recent tendency to establish low records in the New York market. Tuesday tin prices became active and remained so during the whole week and at the end of the week it was 45 cents above Monday's price. This was due entirely to the settlement of the Arabic incident. The copper markets were unsettled yesterday due to a sharp break in London standard warrants. Copper agencies say good sales of copper are being made on a basis of 18 cents a pound. While spot copper declined in London, there was no change in electrolytic. Lead was firm, quite a number of sales being made at $4.90 by the leading interest, while outside interests are asking an advance over the official price set by the American Smelting & Refining Co. The leading situation appears to be in full control of the producers and further advance in the price is looked for this week. The munition makers are reported to be seeking to cover up to the end of the year, but sellers are not as yet prepared to sell this far ahead. The price which was established yesterday was $4.90 per 100 lb. There being a net gain of 45 cents at the end of the week.

A slight change took place in the aluminum market with a gain of 1 cent while antimony declined 2½ cents. The rest of the metal markets made no changes. The oil and lubricants markets were weak with but one change. This change took place on Friday when gasoline rose 1 cent. The rest of the markets made no changes.

Hurlburt Leases Mott Iron Works

NEW YORK CITY, Aug. 28—The Hurlburt Motor Truck Co. has leased the old plant of the Jordan L. Mott Iron Works, on Harlem River and Mott Haven Canal, between Third Avenue and 133d Street, this city.

The company has orders for over 1000 trucks to be used as Red Cross ambulances in the European war, and will treble its force of workmen to operate a full twenty-four hours in shifts of eight hours, employing over 300 men.

Detroit Steel Products Adds Again

DETROIT, MICH., Aug. 30—For the third time this year the automobile springs department of the Detroit Steel Products Co. is being enlarged. The present addition will be a one-story structure which will add 15,000 sq. ft. of floor space to the department.

"Business thus far this year is fully 50 per cent ahead of 1914," said an official of the company. "August will show to have been the best month we ever had. We have 800 men on the payroll and we are working to full capacity, with three shifts."

Velie Makes Factory Changes

MOLINE, ILL., Aug. 27—Increased production will be the result of the changes being made at the plant of the Velie Motor Vehicle Co., this city. The six-story building heretofore used for storage purposes will hold the final assembly departments and shipping rooms. With this new arrangement rough material is received at the west end of the main plant, and finds its way through the machine shop, first assembly and test, hence to the final assembly, where the bodies await installation, after which the completed cars are shipped.

Lenox Plant Moved to Lawrence

LAWRENCE, MASS., Aug. 30—The Lenox Motor Car Co., Boston, Mass., will build a reinforced concrete factory to cost $100,000 in this city. It is stated that the company will enter the commercial vehicle field.

St. Louis Body to Lease Plant

ST. LOUIS, MO., Aug. 27—The Commercial Auto Body Co. has closed a lease for the building at the southeast corner of Sixteenth and Pine Streets, this city, to be used as a plant for building commercial bodies. The offices and showrooms at 3003 Locust Street will be

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum	.33	.33	.33	.34	.34	.34	+.01
Antimony	.31	.28	.28½	.28½	.28½	.28½	—.02½
Beams & Channels, 100 lb.	1.47	1.47	1.51	1.51	1.51	1.51	+.04
Bessemer Steel, ton	23.00	23.00	23.00	23.00	23.00	23.00	.....
Copper, Elec., lb.	.16	.17	.17¾	.17¾	.17¾	.17¾	+.01¾
Copper, Lake, lb.	.16½	.16⅞	.18½	.18½	.18½	.18½	+.02
Cottonseed Oil, bbl.	5.45	5.54	5.57	5.65	5.65	5.68	+.23
Cyanide Potash, lb.	.23	.23	.23	.23	.23	.23	.....
Fish Oil, Menhaden, Brown	.39	.39	.39	.39	.39	.39	.....
Gasoline, Auto, bbl.	.14	.14	.14	.14	.15	.15	+.01
Lard, Oil, prime	.85	.85	.85	.85	.85	.85	.....
Lead, 100 lb.	4.45	4.60	4.70	4.90	4.90	4.90	+.45
Linseed Oil	.54	.54	.54	.54	.54	.54	.....
Open-Hearth Steel, ton	23.50	23.50	23.50	23.50	23.50	23.50	.....
Petroleum, bbl., Kan., crude	.75	.75	.75	.75	.75	.75	.....
Petroleum, bbl., Pa., crude	1.60	1.60	1.60	1.60	1.60	1.60	.....
Rapeseed Oil, refined	.77	.77	.77	.77	.77	.77	.....
Rubber, Fine Up-River, Para	.57	.57	.57	.57	.57	.57	.....
Silk, raw, Ital.	3.70	..	3.75	..	..	3.75	+.05
Silk, raw, Japan	3.55	..	3.50	..	..	3.50	—.05
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	33.75	34.25	35.00	34.50	34.50	34.20	—.45
Tire Scrap	.04¾	.04¾	.04¾	.04¾	.04¾	.04¾	.....

retained by the company for the present.

The new factory has four floors and a basement. About 30,000 sq. ft. of floorspace will be available. The bodies will not be assembled, but will be built from the raw material in the plant. The basement will be used for a mill room, the second floor for assembling, the third floor for trimming, and the fourth for painting and finishing.

Heretofore the company has built bodies for Ford chassis only. In the new plant custom work for all makes of chassis will be done.

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Crane Plant Sold

BAYONNE, N. J., Aug. 30—The entire plant in this city of the Crane Motor Car Co., has been purchased by the Car Lighting & Power Co. The plant will be used by the Clothel Co., the subsidiary of the Car Lighting & Power Co., which manufactures apparatus for refrigeration.

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Scripps-Booth Adds to Plant

DETROIT, MICH., Aug. 30—Its present plant being inadequate to meet its increasing business, the Scripps-Booth Co. is now having erected a three-story plant on Bellevue Avenue, across from its present location. When this plant is completed a production of 100 cars a day will be possible, and the present working force will probably be doubled.

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Dividends Declared

Packard Motor Car Co., Detroit; quarterly of 1¾ per cent on preferred; payable Sept. 15.

Securities Markets Strong

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General Motors Makes High Record After the Arabic Settlement

NEW YORK CITY, Aug. 30—Assuming frankness and sincerity in the latest German assurances, financial interests in New York regard last week's developments in connection with the destruction of the Arabic as of paramount importance to the financial situation. With better understanding between Washington and Berlin the markets once again show up strong. For the most part, stocks showed increase in tone on Saturday, when the majority of issues recorded net advances. One of the important advances was that of General Motors common which rose seventeen points, while that of the preferred rose three points. There were many other notable changes such as Willys-Overland common which rose thirteen points and Studebaker common with a rise of twelve and one-half points. Among the tire issues the largest change took place on Saturday, Kelly-Springfield common rising ten points. Firestone common rose seven points.

Few Declines

There were a few declines this week which ranged from one to five points. The heaviest decline was that of Vacuum Oil which dropped five points, while that of Goodrich preferred and Goodyear common both declined one point. In a general way closing pric were under the best. Trading was on heavy scale, with very many shares changing hands.

The Detroit issues also picked up with the settlement of the Arabic incident, there being but three declines. The rest of the stocks showed good gains. The gains ranged from one to five points. Continental common, Packard common, and General Motors common rose five points. The bond markets were quiet with no trading.

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N. Y. Exports Amount to $233,531

NEW YORK CITY, Aug. 30—Automobiles valued at $233,531 were shipped from this city during the week ending Aug. 21. Shipments for the same period last year amounted to $336,920 in automobiles, and $1,907,798 in trucks.

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65,183 Visit Ford Plant

DETROIT, MICH., Aug. 30—During the fiscal year of the Ford Motor Co. which ended Aug. 1, the plant was visited by 65,183 persons. This is at the rate of over 210 per day for 300 working days. September, 1914, was the record month for visitors, 11,890 having been recorded during 26 working days or 457 per day.

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Boosters' Outing Sept. 22

NEW YORK CITY, Aug. 30—The Motor Club Boosters will hold an outing at Fred Wagner's farm at Smithtown, L. I., on Sept. 22. William Allen of the Allen Co., is general manager.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ge
Ajax-Grieb Rubber Co. com			300	..	..
Ajax-Grieb Rubber Co. pfd			101	110	..
Aluminum Castings pfd			100	104	..
J. I. Case pfd			70	80	..
Chalmers Motor Co. com			90½	92	+ 1½
Chalmers Motor Co. pfd			95	97	+ 1
Electric Storage Battery Co			65	68	+ 2¼
Firestone Tire & Rubber Co. com			525	530	+ 7
Firestone Tire & Rubber Co. pfd			111	..	..
General Motors Co. com			219	220½	+17
General Motors Co. pfd			109½	110½	+ 3½
B. F. Goodrich Co. com			62	63	+ 7
B. F. Goodrich Co. pfd			106	108	— 1
Goodyear Tire & Rubber Co. com			270	274	— 1
Goodyear Tire & Rubber Co. pfd			108½	110	..
Gray & Davis, Inc., pfd			..	..	..
International Motor Co., com			28	30	+ 5
International Motor Co. pfd			59	60	+ 9
Kelly-Springfield Tire Co. com			185	190	+11
Kelly-Springfield Tire Co. 1st pfd			85	87	..
Kelly-Springfield Tire Co. 2d pfd			175	185	+ 1
Maxwell Motor Co. com			42	43¼	+ 2
Maxwell Motor Co. 1st pfd			90	92	+ 4
Maxwell Motor Co. 2d pfd			35	37	+ 1
Miller Rubber Co. com			190	194	..
Miller Rubber Co. pfd			107½	..	+ ½
New Departure Mfg. Co. com			..	..	..
New Departure Mfg. Co. pfd			..	..	..
Packard Motor Car Co. com			117	..	+ 5
Packard Motor Car Co. pfd			100	..	+ 1
Peerless Motor Car Co. com			140	150	+10
Peerless Motor Car Co. pfd			..	..	..
Portage Rubber Co. com			46	48	+ 4
Portage Rubber Co. pfd			93	94	+ 1
*Reo Motor Truck Co			17	18¾	..
*Reo Motor Car Co			33	34½	+ ½
Splitdorf Electric Co., pfd			..	..	..
Stewart-Warner Speed. Corp. com			65	66	+ ½
Stewart-Warner Speed. Corp. pfd			105	107	..
Studebaker Corporation com			111½	112½	+12½

No quotations available on account of war.

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ge
Studebaker Corporation pfd			103	105	+ 1
Swinehart Tire & Rubber Co			88	90	+ 3
Texas Company			150	151	..
U. S. Rubber Co. com			49	51	+ ½
U. S. Rubber Co. pfd			103	105	+ 1
Vacuum Oil Company			214	219	+ 5
White Company pfd			110	..	..
Willys-Overland Co. com			182	184	+13
Willys-Overland Co. pfd			106	106¾	+ 1

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Chalmers Motor Co. com	..	98	89½	..	..
Chalmers Motor Co. pfd	..	..	95	97	— ¼
Continental Motor Co. com	155	180	..	300	+ 5
Continental Motor Co. pfd	..	75	83	87	+ 1
General Motors Co. com	..	..	217	221	+ 5
General Motors Co. pfd	..	..	109	111	+ 2
Maxwell Motor Co. 1st pfd	..	..	89	92	+ 1
Maxwell Motor Co. 2d pfd	..	..	35½	39	+ 1
Maxwell Motor Co. com	..	..	41½	45	— 1
Packard Motor Car Co com	..	..	120	130	+ 5
Packard Motor Car Co. pfd	94	..	100	102	+ ½
*Reo Motor Car Co	19½	20½	..	33½	— ½
*Reo Motor Truck Co	..	12¾	17⅜	18	— ⅛
Studebaker Corp. com	..	..	112	115	+ 5
Studebaker Corp. pfd	..	..	102	106	— 2

INACTIVE STOCKS

*Atlas Drop Forge Co	19	..	27	30	..
Ford Motor Co. of Canada, Ltd	..	550	..	1525	..
Kelsey Wheel Co	..	..	205	..	..
*W. K. Prudden Co	..	20½	20¼	22	..
Regal Motor Car Co. pfd	23	..	..	21	..

BONDS

General Motors, notes, 6s, 1915	..	100	..	..	..
Packard Motor Car Co. 5s, 1916	..	..	99	..	+ ½

*Par value $10, all others $100 par value.

Business Tour Reaches 2,850,000

Wisconsin Run Covers Territory Containing 20 Per Cent of State's Population

MILWAUKEE, WIS., Aug. 28.—Approximately 20 per cent of the population of Wisconsin—2,850,000—were placed directly in touch with the 1916 models of the leading automobile manufacturers of America; about 50 per cent were informed of the greatest State fair ever held in Wisconsin, and 65 to 70 per cent were made acquainted in one way or another with all that has to do with good roads, motor vehicles, travel, speed, roadability, scenery and natural resources of the Badger commonwealth, by the booster tour undertaken by the Milwaukee Automobile Dealers, Inc., from Aug. 23 to 27 inclusive, over a route of more than 650 miles, covering the richest and most productive territory of Wisconsin.

The first day the tour covered 109 miles, from Milwaukee to Janesville, Wis., by way of Racine, Burlington, Delavan and Beloit. On the second day 153 miles were covered, and at noon the tourists were within 17 miles of Milwaukee. Wednesday the route measured only 101 miles, being from Madison, the State capital, to Oshkosh. The fourth day took the tour from Oshkosh to Green Bay, 114 miles, by way of the Fox River valley, one of the most fertile agricultural and manufacturing districts in the Middle West. On Friday, 131 miles were covered in the run home from Green Bay along the west shore of Lake Michigan.

Close observation of the cars participating in the tour shows that not one experienced mechanical trouble of any kind, necessitating any delay on the road, and if the tour had been run under grade 3 rules of the A. A. A., each entrant would have come back with a perfect road score.

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Used Car Pocket Edition Revised

CHICAGO, ILL., Aug. 30—The Chicago Automobile Trade Assn., has issued a revised edition of the pocket edition of its National Used Car Market Report which, like the first edition, is supplemental to the large book, but covers only Zone 7 which centers in Chicago. The book is exactly the same size as its predecessor, but despite the fact that it contains information on 154 makes of cars as against 131 listed in the first edition, it has but eighty-six pages instead of ninety-seven.

A great improvement has been made in the method of listing the data and the operation of ascertaining information on a particular car has been considerably simplified. In the first edition, information concerning the model, year, type and list price was given in "run in" form and was not as easy of access as in the new form. In the new edition complete information on each model is given on a single line reading across one page, the "run in" paragraph at the end having been eliminated.

The book contains the following concrete information compiled from the data in the main edition on Zone 7: "U. S. Average"; "As Is Sales"; "As Is Appraised"; the latter being derived from the appraisements made by the committees in Zones 1, 7 and 9.

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25 Exhibitors to Date for Michigan State Fair

DETROIT, MICH., Aug. 30—The annual Michigan State Fair opens next Monday, Sept. 7, and as in past years the automobile show will be one of the big attractions.

From the list of exhibitors given herewith it will be noticed that most of the local automobile dealers have secured space.

In addition to passenger cars and commercial vehicles there will be several motor tractors and among them, it is said, will be a Ford tractor which will give daily demonstrations.

The list of exhibitors up to to-day is as follows:

Buick Motor Car Co., Buick; Cadillac Motor Car Co., Cadillac; Cunningham Auto Co., Maxwell; Chevrolet Motor Car Co., Chevrolet and Monroe; Chalmers Motor Co., Chalmers; Dodge Bros., Dodge; Denby Motor Truck Co., Denby; Ford Motor Co., Ford; Grasser Motor Co., Hupmobile; Jackson Automobile Co., Jackson; McKenney-Devlin Co., Grant and Haynes, also Vim truck; M. A. Young, Mitchell and Reo; Hudson Motor Car Co., Hudson; Oldsmobile Co., Oldsmobile; Oakland Motor Car Co., Oakland; Overland Detroit Co., Overland; Ross Automobile Co., Ross; Thompson Auto Co., Federal and Commerce trucks; Standard Auto Co., Oakland and G. M. C.; Studebaker Corp., Studebaker; Signal Motor Truck Co., Signal; Standard Motor Truck Co., Standard truck; Kalamazoo Motor Vehicle Co., Kalamazoo truck; Gornor Oil Co., and Kleis & Clouse, Ford starters.

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Dixie Magneto on National Twelve

NEW YORK CITY, Aug. 30—In the description of the twelve-cylinder National appearing in THE AUTOMOBILE for Aug. 19 it was stated that the magneto used is a special Splitdorf. This magneto is the Dixie model for twelve-cylinder motors manufactured by the Splitdorf Electrical Co., Newark, N. J.

90 M. P. H. To Be Twin City Limit

Wavy Surface of Concrete Track Expected to Keep Winner's Speed Down

MINNEAPOLIS, MINN., Aug. 31—*Special Telegram*—The wavy concrete surface of the 2-mile Twin City Motor Speedway track is expected to hold the average speed of the winner of Saturday's 500-mile World's Derby below 90 m.p.h. Elimination trials which were to have begun Monday were postponed until Wednesday, owing to weather and track conditions. In an unofficial trial Monday, Gilbert Anderson, in his Stutz, made a lap of the track in 1:12 4/5, an average of 99 m.p.h.

Only one of the two Peugeots reported recently shipped from France, to be driven by Wilcox and Aitken, has arrived, and it will not be possible for it to reach the track in time for Saturday's race. Wilcox and Aitken are to be Stutz relief drivers. The Peugeot will be ready for the Sheepshead Bay race Oct. 2, and will probably be driven by Johnny Aitken.

H. J. Tremain of Minneapolis has bought the Duesenberg entered in the Twin City race with Henderson as driver, but has elected Ralph Mulford to pilot it on Saturday.

The track is in fine condition and good weather is promised so that the attendance should be 100,000.

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Automobile Racing for Japan

TOKIO, JAPAN, Aug. 27—Automobile racing will be inaugurated in this city when a series of track races will be held in commemoration of the anniversary of the coronation of the Emperor. American cars will be entered, among them being two Mercers, recently sold by G. R. Bentel, the Pacific Coast Mercer distributor, to F. J. Fujioka, the two cars to be driven by W. T. Watanabe and H. Sakamoto.

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De Palma Wins at Kalamazoo

KALAMAZOO, MICH., Aug. 28—Driving a most consistent race and without having the slightest hitch, Ralph De Palma, in his Stutz racer, won the 100 miles race at Recreation Park this afternoon He covered the century in 1:33; 31:40, averaging 65.32 m.p.h. Incidentally De Palma is now richer by $1,000. Bob Burman will receive $700, having finished second in the race in his Peugeot. Third money went to Billy Chandler, who drove a Deusenberg. The fourth prize went to G. F. Patrick, who was at the wheel of a Mercer, while the fifth and last prize

was won by Thomas Ball, driving a Buick.

Ideal weather prevailed and a crowd of from 12,000 to 15,000 people was present when the race started. A thousand automobiles or more were around the course.

Of the race itself there is not much to be said because it was practically a one-man race. De Palma could probably have made better time, but he drove carefully and took no chances. He did not stop once during the entire race.

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Motometers on Elgin Racers

NEW YORK CITY, Aug. 27—Boyce Motometers were on all cars in the races for the Chicago Automobile Club cup and the Elgin national trophy held at Elgin, Ill., Friday and Saturday, Aug. 20 and 21.

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Hyatt Service in San Francisco

DETROIT, MICH., Aug. 30—The Hyatt Roller Bearing Co. will open a new service branch in San Francisco. It will be located at 366 Golden Gate Avenue. This will be the ninth Hyatt service branch now in the country, the others being located in Atlanta, Boston, Detroit, Los Angeles, Minneapolis, Chicago and New York.

The local service branch of the Hyatt company has moved into larger quarters at 751 Woodward Avenue. About Nov. 1 this branch will be moved into the new office building now in course of construction.

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Iowa Dealers in Convention

DES MOINES, IOWA, Aug. 31—The first semi-annual convention of the Iowa Automobile Dealers' Association opened a two-day session here to-day. This is the first convention of its kind to be held in the United States. There are seventeen associations in all. President of the Garage Owners Association of Illinois, W. B. Taylor, and Secretary E. J. McGuirk will address the 600 Iowa dealers. Among those present will be Mayor Hanna of Des Moines, who will give the welcome address. This will be followed with an address by J. Friedman of Dyersville, vice-president of the Iowa Association. Secretary N. L. Seeman will give a report on the Iowa association, which was organized March 10 of this year.

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Grossman Holds Annual Salesmen's Convention

NEW YORK CITY, Aug. 30—The annual salesmen's convention of the Emil Grossman Mfg. Co., Inc., Brooklyn, N. Y., was held in the offices of the company, Bush Terminal, Aug. 27 and 28. Emil Grossman, president of the company, presided.

Since January, 1915, the company has added over 500 new customers. The company's increase in business for this year, over that of 1914, was over 50 per cent.

The following salesmen and other members of the company's staff attended the 2-day sessions of the convention: Emil Grossman, president; J. N. Lowe, vice-president; L. M. Schwartz, secretary; E. C. Delgado, assistant treasurer; A. A. Greene, in charge of sales to manufacturers; N. T. Gutelius, advertising manager; P. L. McIlvaine, export; S. S. Waldman, purchasing agent; M. S. Rosen, engineer; Harry G. Wedler, W. M. Farans, A. E. Rosenberg, R. R. Rosenquist, A. F. White, representative in India and the Far East; J. E. Vidal, representative in Cuba, Porto Rico, South and Central America; E. E. Gamon, factory manager; R. W. Johnson, assistant factory manager; L. G. Hartdorn, assistant factory manager; Carl Postal, assistant factory manager spark-plug department.

Friday evening the members of the convention were entertained by the company at dinner and at the theater. Saturday evening there was a banquet.

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Washington Jitneys Common Carriers

WASHINGTON, D. C., Aug. 28.—Within the next few days orders declaring jitneys common carriers, subject to rules and regulations governing this class of public utilities, will be issued by the Public Utilities Commission. The commission has decided to take this action upon the advice of Corporation Counsel Syme, who recently made an investigation of the jitney situation.

The first step of the commission will be the preparation of rules and regulations governing the jitney service. The companies, as well as individual owners, will be required to file immediate reports of all accidents. Annual reports, which will include a complete statement of their financial operations, together with a general description of their rolling stock, etc., will also be made. The question of an interchange of transfers will be decided later.

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Bosch on Austin and Mercer

NEW YORK CITY, Aug. 31—The Bosch Magneto Co. has closed contracts with the Austin Automobile Co., Grand Rapids, Mich., and the Mercer Automobile Co., Trenton, N. J., to use Bosch magnetos for the coming season.

The Engineers' Forum—Aluminum Pistons

(*Continued from page* 421)

By a system of ribbing, which we have developed ourselves and which gives the dual advantage of quickened thermal conductivity as well as adding rigidity to the dome of the piston, we were able to turn out a piston that weighed less than 12 oz. and under the directions we sent for machining, they have met every requirement, for our pistons have now been adopted for their standard production, which fact speaks for itself.

System of Ribbing

The system of ribbing under the dome which we employ adds greatly to the radiating surface and at the same time strengthens that part of the piston on which the greatest stress occurs, without adding more than a fraction to the weight. Two of the ribs are extended to reinforce the wristpin bosses, offering a solid dome construction from the stress point above the wristpin to the center of the piston head.

The advantages following a correct installation of aluminum alloy pistons are sufficiently well known among your engineering readers so that this feature of the discussion is scarcely worth mentioning here. The principal idea is to offer the foregoing suggestions gained through experience and for the guidance of those who would gain the benefits of Magnalite pistons.

As to aluminum alloy cylinders, it is only fair to state that their present development is somewhat embryonic, although we have successfully cast quantities of them for aeroplane work and unquestionably they will have a broad future in the automobile trade. Just as the problems of aluminum alloy pistons have been solved, so in time will come the full development of the aluminum cylinders, and it is my prediction that sooner than is now expected, an alloy metal will be produced, having all the advantages of light weight and with a bearing surface which will not require the use of a reinforcing iron cylinder sleeve.

Copper and iron have been known and used for fifty centuries but aluminum has been commercially known for but thirty years and the industrial possibilities yet to be developed from the manipulation of aluminum are just beginning to appear.—WALKER M. LEVETT, Walker M. Levett Co.

Factory Miscellany

United Truck Extends — The United Motor Truck Co., Grand Rapids, Mich., is building additions to its plant.

Thermoid Rubber Adds — The Thermoid Rubber Co., Trenton, N. J., will build a two-story, 71 by 190 ft. addition to its plant.

Garford Truck Adds—The Garford Motor Truck Co., Lima, Ohio, is building an addition to its plant at an estimated cost of $20,000.

Pathfinder to Build—The Pathfinder Co., Indianapolis, Ind., has had plans prepared for the construction of a 60 by 400 ft. addition to its plant.

Maine Co. to Make Automobiles—The E. E. Wentworth Corp., Springvale, Me., will construct a plant for the manufacture of automobiles at a cost of $50,000.

American Steel Installs Furnace.—The American Steel Foundries, Chicago, Ill., has installed a 6-ton electric furnace of the Heroult design at its Indiana Harbor, Ind., plant for the production of automobile and other castings.

Sheldon to Treble Output.—The Sheldon Axle Co., Wilkes-Barre, Pa., is increasing its output of worm-drive truck axles by the installation of new machinery and special equipment. After the additions are completed, it expects to treble its output.

Chevrolet Buys Toronto Plant — The Chevrolet Motor Co. of Canada, Ltd., Toronto, Ont., will on Oct. 1 take possession of the plant of the Dominion Carriage Co., Ltd., West Toronto, which it has purchased. It hopes to have cars ready for delivery in three months.

Scripps-Booth New Factory — Ground has been purchased and work is now going forward as rapidly as possible on a new three-story fireproof factory which will be the home of the Scripps-Booth Co., Detroit. The new factory will have a capacity of 100 cars a day.

New Automobile Co. in Mich —The Francisco-Martin Motor Co., Newport, Mich., has been incorporated with $30,000 capital stock to manufacture automobiles. The incorporators are G. W. Francisco, L. J. Martin and F. B. Scholl. It is stated that the company will erect a factory at Newport.

Internal Gear Drive News Issued.—The Internal Gear Drive Assn., Detroit, Mich., has published the first issue of the Internal Gear Drive News, which is to cover the growth of the internal gear drive idea, as applied to motor trucks throughout the world. It will also tell of the service these axles are giving.

Sterling Wheel Erecting Plant — The Sterling Wheel Co., 245 Oregon Street, Milwaukee, manufacturer of ball-bearing resilient wheels for automobiles and motor trucks, which was recently reorganized and the name changed from T. S. Wheel & Mfg. Co., with W. M. Swift Miller, Milwaukee, as president and general manager, is building a plant at Eighth and Oklahoma Avenues.

Timken Forge Plant Progressing.—Work on the new drop forge plant of the Timken-Detroit Axle Co. is progressing. The new upright boilers are in place and the steel frame work is now being erected. The new worm-drive axle assembly plant recently finished is now in operation with a full new equipment of machinery. This plant gives the worm-drive axle plant about 100,000 additional square feet of floor space.

Crown Fender Plant in Ypsilanti—The Common Council of Ypsilanti, Mich., has made it possible for a new industry to locate there with the prospect of employing from 500 to 2500 men when fully running. This is the newly organized Michigan Crown Fender Co., which will manufacture fenders for automobiles and other metal stampings. The city purchased a site and will erect a building 400 by 80 ft. for the concern, which later expects to purchase the property. It is stated that the Ford company will use a large part of the output.

Haynes Additions to Cost $250,000.—Additions to the plant of the Haynes Automobile Co., Kokomo, Ind., will cost $250,000. A large office building is now being completed and will stand outside the old plant, the offices of which will be made a part of the space given over to the manufacture. In addition there will be erected at once three new steel and concrete structures alongside of the present factory. There will be new painting, testing, power plants and also a new building for the storage of rough and finished materials and cars.

The Automobile Calendar

Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 4	Twin City, Minn., 500-Mile Race; Twin City Motor Speedway Co.
Sept. 6-9	Worcester, Mass., Show, Dealers' Assn.
Sept. 6-10	Indianapolis, Ind., Show, Indiana State Fair.
Sept 6	Reading, Pa., Show, Hotel Berkshire.
Sept. 6-15	Detroit, Mich., Show, Michigan State Fair.
Sept. 8-11	Hamline, Minn., 2-Day Meet at State Fair Grounds between Minneapolis and St. Paul, State Fair.
Sept. 13-17	Milwaukee, Wis., Show, Automobile Dealers' Assn.
Sept. 13-17	Oakland, Cal., Pan-American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 18	Providence, R. I., 100-Mile Race, Narragansett Park Speedway, Inc.
Sept. 18-25	Los Angeles, Cal., Show, Shrine Auditorium.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Sept. 24	Indianapolis, Ind., S. A. E. First Section Meeting.
Sept. 26-Oct. 10	Denver, Col., Show, International Soil Products Exposition. Automobile Trades Assn. of Colorado.
Oct.	Dallas, Tex., Show, Dallas Automobile Dealers' Assn.
Oct.	Los Angeles, Cal., Broadway Automobile and Flower Show, Automobile Dealers' Assn.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 2	New York City, Sheepshead Bay Motor Speedway Track Meet.
Oct. 2	Fresno, Cal., 150-Mile Race, District Fair, Fresno County Agricultural Assn., C. G. Eberhard.
Oct. 2-9	Cincinnati, Ohio, Show, Music Hall, Cincinnati Automobile Dealers' Assn.
Oct. 4-10	St. Louis, Mo., Show, Forest Park Highlands, St. Louis Automobile Manufacturers and Dealers' Assn.
Oct. 4, 5, 6	Columbus, O., Garage Owners Convention.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Oct. 9	Indianapolis, Ind., 100-Mile Invitation Race, Motor Speedway.
Oct. 11-12	Dayton, O., National Paving Brick Manufacturers' Assn., Annual Meeting.
Oct. 14	Chicago, S. A. E. Standards Committee Meeting.
Oct. 16	Chicago, Ill., 350-Mile Race, Chicago Speedway.
Oct. 18-19	Cleveland, O., Hotel Statler, Sixth Annual Convention, Electric Vehicle Assn. of America.
Nov. 1-3	Pasadena, Cal., Show, Hotel Green, Walter Hempel.
Nov. 18	Arizona 150-mile Grand Prix.
Nov. 20	Corona, Cal., Road Race.
Nov. 29-Dec. 4	Electric Prosperity Week.
Dec. 31	New York City, Show; Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.
Jan. 24-29	Buffalo, N. Y., Show, Buffalo Automobile Dealers' Assn., Broadway Auditorium.
March 4-11	Boston, Mass., Truck Show, Mechanics Bldg.

The Week in the Industry

Bamford Detroiter Production Manager—W. R. Bamford has been appointed production manager of the Detroiter Motor Car Co., Detroit.

Thorpe Truck-Tire Manager — G. L. Thorpe has been appointed manager of the truck-tire department of the Hood Tire Co., St. Louis, Mo.

Shaw Heads Dallas Co.—The Dallas Qualityre Co., Dallas, Tex., has been organized in Dallas with Lamonte Daniels president and L. L. Shaw vice-president. Mr. Shaw is in charge.

Conrad Sphinx Sales Manager—H. W. Conrad, formerly sales manager of the Pullman Motor Car Co., York, Pa., has been appointed sales manager of the Sphinx Motor Car Co., York.

Hitchcock Truck Dept. Head.—A. S. Hitchcock has been appointed truck department manager of the Cadillac Auto Co. of R. I., Providence. This concern handles the General Motors trucks.

Dealer

New Supply House for Ala.—The Auto Supply Co., J. R. Jones, manager, has been formed in Dothan, Ala., to handle a general line of accessories, etc.

Swan Carbureter Agency—The Los Angeles Ignition Works, which recently moved into a new building at 1007-1011 Main Street, Los Angeles, Cal., have secured the agency for the Swan carbureter for Orange and Los Angeles counties. The Swan carbureter is a San Francisco product which is working into great favor on the Pacific Coast.

Packard at Manchester.—Alvan T. Fuller, who has the agency for the Packard line at Boston, Mass., Portland, Me., and Providence, R. I., has added Manchester, N. H., to his list, having opened an agency there last week on Merrimac Street. F. B. Freeman has been placed in charge of the Manchester agency. He had the Stutz agency in Boston until a few weeks ago.

Cleveland Agencies Moving—The H. F. Neighbors Co., Cleveland agent for the Dodge, has secured a site at the corner of Chester Avenue and Twenty-second Street, upon which two structures will be erected. One has been started and the other will be started soon. The structure under way will have 18,000 sq. ft. of floor space and the other structure will contain 22,000 sq. ft. The Buick agency will be moved off of Euclid Avenue next year.

Motor Men in New Roles

Nachtrib Goes to Dallas.—E. R. Nachtrib, formerly factory representative of the Willys Overland Co., Toledo, Ohio, has been appointed assistant to Manager Taxis of the Dallas, Tex., branch.

Smith Edison's Detroit Office Mgr.—Bertram Smith, well known in the storage battery business for the past fifteen years, has been appointed manager of the Detroit office of the Edison Storage Battery Co.

Bryant Standard Welding Factory Manager—R. S. Bryant, for many years consulting engineer of the Standard Welding Co., Cleveland, Ohio, has been appointed factory manager in charge of all manufacturing.

Jones Sun Branch Mgr.—S. A. Jones has been appointed western branch manager for the Sun Motor Co. and is expected in Dallas next week to close arrangements for the opening of a branch house in this city.

Has Entire State Agency.—J. W. Gogarn, who was recently given the agency for the Mitchell line at New Haven, Conn., has been made agent for the entire State as a distributor for the Carl H. Page Motors Co. of New York.

Parrish Denby Sales Manager — The Denby Missouri Truck Co., 405 North Twenty-second Street, St. Louis, Mo., has been appointed distributer of the Denby truck in the St. Louis district. G. Y. Parrish will be sales manager of the new concern.

Gaston Cadillac Rep.—George Gaston, formerly salesman for the Munger Automobile Co., the Dallas Cadillac agency, is now district representative for the Cadillac Motor Car Co. His territory embraces Texas, Missouri, Kansas, Oklahoma, Arkansas and Louisiana.

Thackston Dallas Hupp Mgr.—E. O. Thackston will be general manager of the Dallas Hupmobile Co., Dallas, Tex., with F. N. Abbott as territorial manager. Hupmobiles will be handled exclusively in sixty-five counties of North, East and West Texas. This organization will be in the way of a factory branch. A new building at 2210-2212 Commerce Street is being erected for the company and this will be the salesrooms and parts department.

Recent King Changes.—B. R. Hayden has joined the King Motor Co. of Chicago as sales manager. G. W. Franklin has resigned from the Wetmore-Quinn Co. to join the A. A. Crumley Co., Michigan State distributor for the King car, as sales manager. Mr. Franklin was formerly sales manager for the Regal Motor Car Co. Bert Collins, late of the Studebaker Corp., has joined the King Motor Car Company as a special factory salesman. His position is a new one created for the purpose of making jumps to certain points where co-operation with dealers, old or prospective, is needed. He will have no particular territory. A. J. Smith has returned to the automobile business and is now sales manager for the Reliance Automobile Co., northern California, distributor for the King eight.

Dealer

To Distribute Danver Oiler—The Danver Sales Co., 17 Custom House Street, Providence, R. I., will distribute the Danver auxiliary oiler for Ford cars.

Pasadena Savage Tire Moves — The Savage Tire Co.'s Pasadena branch, under the managership of Frank Verbeck, former racing driver, is located in its new quarters, 43-45 East Union Street.

Recent N. Y. Trade Changes.—The Akron Tire Co. has leased a store at 1789 Broadway, New York City, and the Lyons-Atlas Co. service station at 1876 Broadway has been leased to the Lexington Motor Car Co.

Moves to New Quarters.—The Henshaw Motor Car Co. of Boston, agent for Dodge Bros. cars, has leased the building 915-921 Boylston Street that was built especially for the E. R. Thomas Co. when it opened a branch at Boston with Mr. Henshaw in charge. It was later occupied by the Garford agents, but for some months has been idle. Mr. Henshaw will utilize the entire building, but he will also continue his service station at the Motor Mart.

Indianapolis Republic Tire Distributor —The Varney Electric Supply Co. Indianapolis, Ind., has been appointed distributor for the Republic tire. The territory controlled by the Varney company includes all of Indiana (with the exception of a few counties in the northeastern part of the State), southern Illinois and the western portions of Kentucky and Tennessee. S. C. Walker, secretary and treasurer, has complete charge of tire sales and has eight district men under his jurisdiction.

Automobile Agencies Recently Established

PASSENGER VEHICLES

Alabama

Opelika	Abbott-Detroit	C. R. Summers

Arkansas

Little Rock	King	U. S. Motor Co.

California

Los Angeles	Paige	Smith Brothers
Oxnard	Dodge	Oxnard Garage
Oxnard	Hudson	Oxnard Garage
Pomona	Chandler	Potter & McCormack
Ventura	Ford	Claude C. Needham
Visalia	Dodge	Charette-Pennebaker Co
Portersville	Dodge	J. W. Stephens
Redlands	Maxwell	Hatfield & Ayres

Colorado

Akron	Saxon	M. W. Lewis
Alamosa	Overland	E. J. Best
Alamosa	Hudson	R. R. Sumner
Arvada	Dort	Arvada Motor Car Co.
Aspen	Overland	Aspen Automobile Co.
Aspen	Saxon	Gerbaz & McPhee
Berthoud	Overland	Jeffere Auto Co.
Boulder	Hudson	N. U. Wallace
Boulder	Overland	J. C. Deckelman
Boulder	Saxon	B. C. Garbarino
Byers	Overland	C. C. Shetler
Canon City	Overland	York Auto Co.
Broomfield	Reo	Walter W. Wilcox
Colorado Springs	Dort	Big Four Auto Co.
Colorado Springs	Reo	Beecher Motor Co.
Craig	Saxon	Anderson & Brokaw
Cripple Creek	Dort	E. J. Williams
Cripple Creek	Saxon	Clark Supply Co.
Cheyenne Wells	Dort	T. C. Turner
Deertrail	Dort	G. I. Williams
Denver	Chalmers	E. J. Johnson
Denver	Cole	Colorado Motor Car Co.
Denver	Dort	J. S. Morri on
Denver	Jackson	Regal Sales Co.
Denver	King	Regal Sales Co.
Denver	National	W. W. Beeson
Denver	Regal	Regal Sales Co.
Denver	Paige	L. G. Palmer
Denver	Velie	John Deere Plow Co.
Edwards	Paige	A. W. Burnison
Elbert	Buick	Theodore Neuman
Flagler	Saxon	William Seal
Fort Collins	Reo	Jackson-Ankney Merc. Co.
Fort Collins	Saxon	G. Harold D. Parker
Fort Collins	Buick	G. Harold D. Parker
Fort Collins	Paige	J. C. Hunt
Fort Morgan	Reo	A. C. Gillette
Glenwood Springs	Cole	Bart Patrini
Grand Junction	Paige	Western Colorado Motor Sales Co.
Greeley	Dort	Lee Bros.
Greeley	Reo	J. B. McCutcheon
Greeley	Buick	Weld County Garage
Hayden	Cole	Dawson Auto Co.
Holyoke	Saxon	G. W. Garland
Hugo	Saxon	Cobb & Hatton
Idaho Springs	Paige	Richard E. Staley
Lamar	Saxon	Hartman Auto Co.
Lamar	Reo	Miller Bros.
Las Animas	Reo	F. W. McCune
Leadville	Cole	O. W. Reynolds
Longmont	Saxon	Shaw & Shickle
Loveland	Reo	Anderson & Griffin
Loveland	Saxon	Stewart & McFadden
Monte Vista	Paige	Stephens & Corrington
Paonia	Paige	Joseph Carlstrom
Placerville	Dort	M. B. Stone
Pueblo	Paige	Spitzer Bros.
Steamboat Springs	Oakland	L. I. Brown
Timnath	Cole	Giddings & Carey
Trinidad	Saxon	Mack Patterson
Trinidad	Cole	Trinidad Garage Co.
Trinidad	Paige	George D. Single
Windsor	Reo	P. A. Bartz
Windsor	Paige	H. E. Hickman
Yuma	Dort	L. J. Titterington
Yuma	Saxon	Heiserman & Mouser

District of Columbia

Washington	Grant	C. L. Burrows & Co.

Florida

Lake City	King	National Highway Garage
Tallahassee	King	Brown's Garage

Georgia

Columbus	Abbott-Detroit	C. E. Porter, Jr.

Idaho

Blackfoot	Oldsmobile	Red Cross Garage

Illinois

Aurora	Oldsmobile	L. D. Krumlauf
Bloomington	Hupmobile	F. G. Oseminger
Bloomington	Reo	F. H. Cole
Cerro Cordo	Jeffery	C. W. Adams
Decatur	Hupmobile	G. W. Ehrhart
Sublette	King	Leffelman & Lauer
Welden	Reo	M. F. Shinneman

Iowa

Council Bluffs	Chandler	Kimball Tire Case Co.
Des Moines	Auburn	Iowa Motor Sales Co.
Des Moines	Westcott	Iowa Oldsmobile Co.
Earling	Chandler	F. W. Wilmerding
Lemars	Oakland	Kilburn-Rickabaugh Co.
Long Tree	Abbott-Detroit	H. U. Baker
Oakland	Oakland	F. W. Pierce
Redfield	Hupmobile	A. E. Smith
Shenandoah	Oakland	A. F. Woodard
Silver City	Oakland	F. W. Anderson
Stanton	Oakland	Stanton Auto Co.
Traer	Chandler	T. F. Cohort

Indiana

Connersville	Lexington	Inland Motor Sales Cor.
New Castle	Maxwell	Claude Stanley
Richmond	Detroiter	Geo. H. Schultz
Roann	Oldsmobile	J. E. Clingaman
South Bend	Vim	Wm. Devall

Kansas

Atchison	King	E. J. Donnelly
Dodge City	King	Howell & Rinehart Co.
Haviland	Auburn	V. B. Clements
Phillipsburg	Chandler	W. H. Champlin

Kentucky

Covington	Hupmobile	B. B. Hume
Mt. Vernon	Hupmobile	W. J. Schleicher

Maine

Dexter	Maxwell	Blainsdell Auto Co.
Greenville	Chandler	W. R. Dailey

Maryland

Hagerstown	Regal	Young Motor Car Co.
Oakland	Chandler	Ravescroft Garage

Massachusetts

Boston	Detroit Electric	E. Y. Stimpson
Boston	Detroiter	Geo. G. Reed
Boston	Pathfinder	Regal Motor Sales Co.
Boston	Velie	J. W. Bowman Co.
North Adams	Studebaker	W. J. Shaw
Webster	King	Robert V. Cassidy
Worcester	Abbott-Detroit	Mavkel Auto Co.
Worcester	Studebaker	Studebaker Corp.
Worcester	Velie	O. A. Kelley Co.

Michigan

Battle Creek	Chalmers	Jackson Garage
Battle Creek	Dort	United Motors Co.
Bay City	Detroiter	F. O. Rockwell
Bay City	Hollier	Stohl Auto Co.
Detroit	Dort	A. A. Crumley
Detroit	King	A. A. Crumley
Escanaba	Dodge	John E. Jackson
Farmington	Oakland	Wm. Goers
Fremont	Dort	Robert Southard
Fremont	Studebaker	Evans-Tinney Co.
Grand Rapids	Chalmers	C. D. Miller
Grand Rapids	Dort	Oswald Motor Car & Supply Co.
Grass Lake	Hollier	T. B. Jones
Howell	Ford	Roy Sprague
Jackson	Cadillac	John A. Bennett
Jackson	Paige	Temple Garage
Ludington	Studebaker	Peter Peterson
Manton	Overland	A. B. Bartlett
Milan	Detroiter	E. F. Bay
Niles	Dort	A. Gregg
Niles	Ford	Pinkham Bros.
Niles	Studebaker	Felix La Cosse
Oxford	Ford	Charles Howarth
Pigeon	Dort	Leipprandt Bros.
Potterville	Ford	Fhaner Bros.
Rockland	Dort	G. W. Stannard
Rochester	Oakland	W. I. Crawford
Sault Ste. Marie	Dodge	Wynn Auto Sales Co.
Sault Ste. Marie	Oakland	I. L. Linsett
Vassar	Dort	K. C. Mott

Minnesota

Duluth	Winton	I. M. Ford
Kasson	Oldsmobile	Otterness Bros.
Lewiston	Oldsmobile	F. E. Franks
Minneapolis	Kissel	Barclay Auto Co.
Minneapolis	New Era	Reilly Herz Co.
Ortonville	Hupmobile	Art Powell
Redwood	Red	Farrell & Keefe
Silver Lake	Ford	A. L. Banek
St. Paul	Kissel	I. F. Lynch
Worington	King	Ullrich Auto Co.

Missouri

Springfield	Oldsmobile	Benj. Toothman
St. Louis	King	Monarch Motor Sales Co

Montana

Butte	Franklin	The Silver Bow Automobile Co.
Ennie	Dodge Bros.	Porter Nelson
Glendive	King	J. Wieglands

Nebraska

Ainsworth	Oakland	L. F. Corbitt
Beemer	Oakland	C. J. Nellor
Benkelman	Oakland	E. A. Mathews
Broken Bow	Oakland	Carothus & Brittan
Burwell	Oakland	Meyers & Mansail
Ceresco	Oakland	Anderson & Dahlstrom
Clarkson	Oakland	Pokorney & Vrasper
Curtis	Oakland	D. O. Nelson
Dalton	Oakland	J. C. Frandsen
Dunbar	Oakland	E. E. West
Eustis	Oakland	Charles Urbele & Co.
Fremont	Oakland	Electric Garage Co.
Gibbon	Oakland	Walker & Wallace
Gordon	Oakland	A. E. Park
Grant	Oakland	W. A. Westenburg
Hampton	Oakland	Hampton Auto Co.
Holbrook	Oakland	Henry Krause
Howells	Oakland	Mesti Brothers
Julian	Oakland	S. A. Wilberger
Kenesaw	Oakland	Wm. Primm
Kilgore	Oakland	J. H. Fisher
Lincoln	Oakland	F. A. Roehl
Minden	Oakland	J. A. Slater
McCook	Oakland	M. M. Brumley
McCool Jct	Oakland	A. R. Marshall
Nebraska City	Oakland	Grassmueck Bros.
Norfolk	Oakland	Scott Auto Co.
Orleans	Oakland	Lineen Hardware Co.
Ohiowa	Oakland	G. F. Spelde
Osceola	Oakland	Meridian Garage
Petersburg	Oakland	Nick Otelle & Son
Plymouth	Oakland	Nispel & Metcalf
Sargent	Oakland	R. A. George
Senceca	Oakland	Thomas McCawley
Scribner	Oakland	Boll & Zeman
Silver Creek	Oakland	Graham Bros.
Stanton	Oakland	A. V. Johnston Auto Co.
Talmage	Oakland	Charles Brehm, Jr.
Thayer	Oakland	Aug. Heidbreder & Son
Utica	Oakland	Aug. Heidbreder & Son
Valentine	Oakland	H. W. Harper Auto Co.
Wilsonville	Oakland	J. B. Andrez

New Jersey

Atlantic City	Vim	Eastern Motor Co.
Bayonne	Chandler	C. W. Beckman
Bridgeton	King	David R Mitchell
Hammonton	King	Wm. Turner
Merchantville	King	Merchantville Auto Co.
Riverton	King	Geo. M. Weimer Auto Garage
Woodstown	King	John R. Watson

New Mexico

Albuquerque	Oldsmobile	J. L. La Driere
Aztec	Dort	J. G. Black
East Las Vegas	Oakland	Vegas Auto Co.
Ft. Sumner	Oldsmob le	C. Frymire
Las Vegas	Oldsmobile	Midway Garage
Magdalena	Oakland	Magdalena Mch. & Auto Co.
Raton	Oldsmobile	E. G. Love Motor Co.
Tucumcari	Oakland	M. B. Goldenberg

New York

Bayport	Oldsmobile	Wm. L. Mantha & Co.
Buffalo	Dort	A. F. Winegar
Menands	Oldsmobile	H. R. Hill
Penn Yan	Maxwell	Joseph T. Cox
Portchester	Chandler	Reynolds Empire Garage Co.
Suffern	Kissel	Peiper-Blanchard Garage
Watertown	Dort	G. H. Baltz

North Carolina

North Wilkesboro	King	Yadkin Valley Motor Co

Ohio

Akron	Chandler	Baynon Motor Sales Co.
Archbold	Auburn	Yoder & Ehrat
Bridgeport	Pullman	The Bridgeport Auto Sales Co.
Columbus	Abbott-Detroit	Geo. W. Carroll
Columbus	Lewis	Snyder Automobile Co.
Columbus	Maxwell	C. W. Hoffritz
Columbus	Monroe	Windera Motor Sales Co.
Columbus	Scripps-Booth	Broad Oak Automobile Co.
Columbus	Winton	G. E. Thomas Co.
Democracy	Detroiter	W. H. Kunkle
Findlay	Hupmobile	G. W. Gavis & Co.
Huron	Chandler	G. E. Rhinemiller
Ironton	Saxon	Wilbur E. Jones
Lima	Oldsmobile	Cadillac Co. of Lima
Lima	Regal	Lima Regal Sales Co.
Logan	Maxwell	W. H. Nunemaker
Marion	Hollier	E. W. Owne Machine Co.
Marion	Oldsmobile	Barnhouse-Hemmerly Auto Co.
Martins Ferry	Regal	Krim Bros. & Sims
Middletown	Oldsmobile	Bevis & Shartle Machine Co.
Spratt	Dort	G. H. Gillogly
Tippecanoe City	Chandler	Theo. M. Bell
Wilmington	King	Bonta & Davis

Oklahoma

Frederick	Hupmobile	F. W. Emenhiser
Okarche	Hupmobile	E. C. Loosen

Ontario

Ottawa	King	W. C. Greig

Pennsylvania

Bloomsburg	Chandler	Zehner Bros.
Devon	King	Devon Garage
Flourtown	King	Seddon Garage
Germantown Pike	King	Moores Garage
Harrisburg	Westcott	Universal Motor Car Co
Hazleton	King	J. L. Wagner
Hazleton	Vim	John Deach
Nazareth	Abbott-Detroit	James Itterly
New Castle	Maxwell	Jas. P. Cope
Norristown	King	Norris City Garage
Philadelphia	Pathfinder	W. Snellenburg & Co.
Reading	Oldsmobile	Oldsmobile Co. of Reading
Scranton	King	D. M. Campbell
Shamokin	Vim	Erb & Zaring
Souderton	King	R. D. McIntyre

South Dakota

Centerville	Mitchell	Chas. Shidler & R. Smith
Emery	Oakland	P. H. McManus & Son
Turton	Ford	L. G. Mannie

Tennessee

Knoxville	King	Harth Automobile Co.
Knoxville	Westcott	F. A. Carpenter

Texas

El Paso	Kissel	Ploneer Motor Co. Inc.
Marshall	Chandler	L. S. Hawley
Olympia	Chandler	A. N. Daly & V. E Meyers